

THE MINING AND METALLURGICAL

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LOS ANGELES

New York, December 1, 1900

CHICAGO

ORIGINAL ARTICLES IN THIS ISSUE—Importance of Topography in Geological Surveys. With Map. By Benjamin Smith Lyman. Mining in Servia. By H. L. Geissel. The First Electrically Equipped Lead Mine. Three Illustrations. Paris Exhibit of the Copper Queen Consolidated Mining Company. Five Illustrations.

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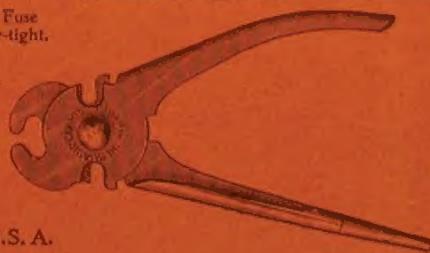
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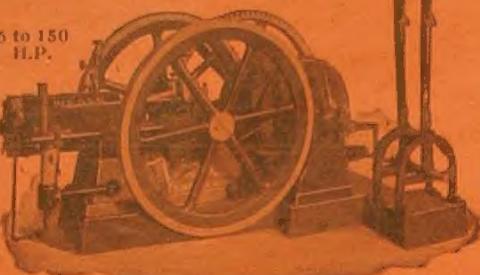
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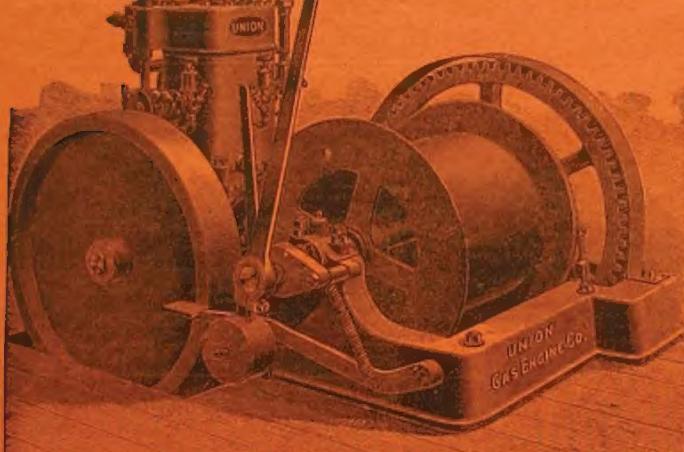
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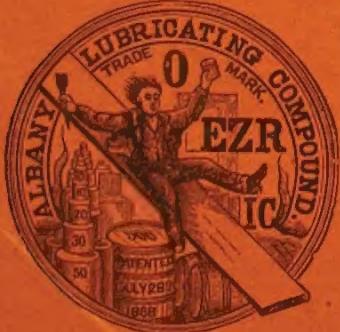
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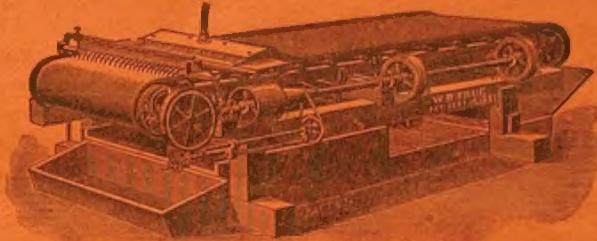
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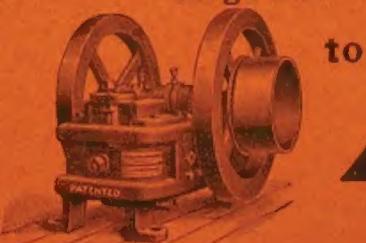
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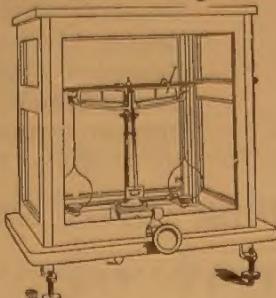
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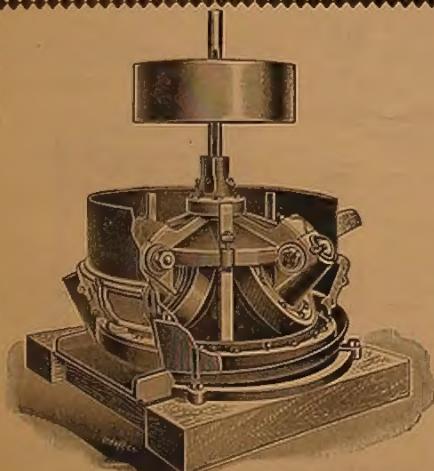
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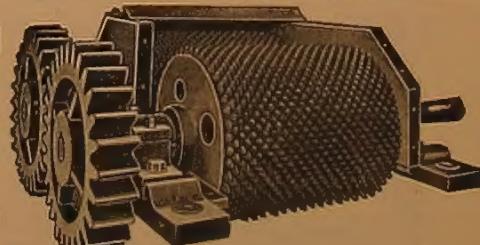
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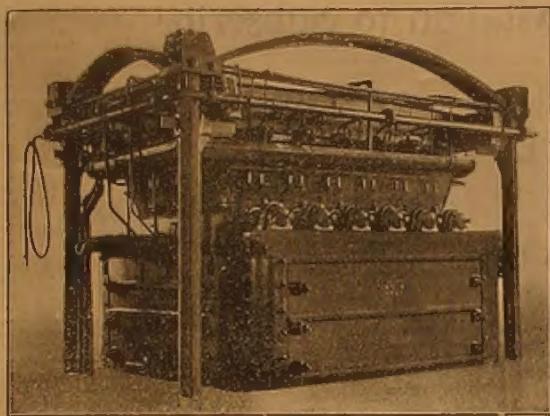
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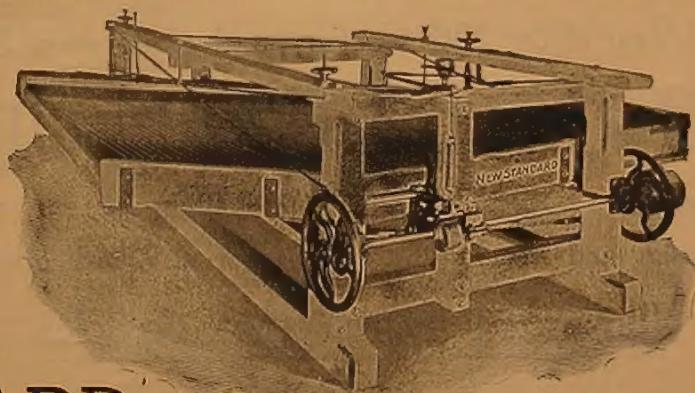
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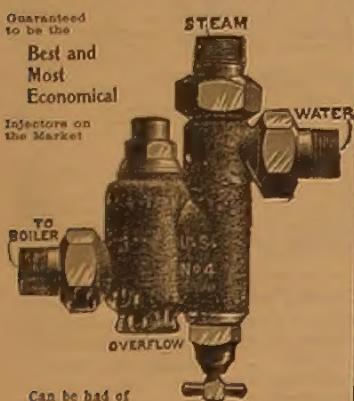
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Geology and Topography.

Geologists and mining engineers will doubtless remember the valuable contributions of Mr. Benjamin Smith Lyman, Min. Engr., Geol., Life Member A. I. M. E., to the "Journal of the Franklin Institute" and to the "Transactions of the American Society of Civil Engineers," on the relations of geology to topography. As Mr. Lyman has made a special study of this matter, "The Mining and Metallurgical Journal" has asked him to prepare for its readers a comprehensive article on the subject. This article will be found in another part of the present issue, and will abundantly repay careful perusal.

normal candles, and provided with a shield to keep off water; a third form being fitted up for electric ignition, and burning ten to eleven hours with a light of one candle.

The American Trade Index.

The National Association of Manufacturers has just issued the third edition of its American Trade Index. This book is a descriptive and classified membership directory of the Association, and in this new edition has developed into a directory of American manufacturing concerns, which makes it a standard reference work of the highest value. It is a volume of 870 pages and consists of an alphabetical list of the Association's members and an alphabetical list of the articles made by these members, each list appearing in both French and English. The registered cable addresses of the members are also given. In the arrangement of the reading matter, the convenience of the buyer was made paramount to all other considerations, and it is certain that the object of the compiler to make the volume a handbook which will assist buyers to open up communication with the leading American manufacturers in the most convenient manner, has been eminently attained. It is difficult to see how an index could be more complete and more carefully arranged for this purpose.

The membership of the National Association now embraces about 1,200 of the largest and most responsible manufacturers of the United States. It is a thoroughly representative organization, comprising every important branch of industry, and covering every section of the country. The membership of a house in the Association is a virtual guarantee as to the high character of its goods. The book is designed for foreign circulation only. It is presented free to foreign business houses, but \$5 is charged for it in the United States.

Mineral Resources of Servia.

Servia has hardly been considered, on this side of the Atlantic at least, as of consuming importance as a mining center. It may, however, interest Americans to know that the mineral industries of that little Balkan State have in recent years been attracting some attention. Mr. H. L. Geissel contributes to this issue of "The Mining and Metallurgical Journal" an article on the present condition of mining in Servia. For about eighteen years, Mr. Geissel has been travelling over Europe, the north coast of Africa, Asia Minor, etc., and has, therefore, had abundant opportunity to study from personal experience the relative importance of mining in different countries.

Servia, as most readers are aware, is located in the Balkan Mountains, between the Adriatic and Black Seas. From a mineral point of view, it is far more important than any of the other states of the group in which it is located. Its area is a trifle over 19,000 square miles, while its population, largely agricultural, somewhat exceeds 2,300,000. The mineral resources of the country include various kinds of coal, besides valuable deposits of silver, lead, zinc, iron, gold, copper, asbestos, quicksilver, antimony, and oil shales. Many concessions have been made to companies and private individuals for working the mines, and the State itself also operates a number of mining properties. While nature has endowed Servia with considerable mineral riches, better transportation facilities between the mineral sections and the outside world will be necessary before the development of the mines can reach anything like the perfection it has in America. The most famous Servian in the United States, by the way, is Mr. Nikola Tesla, the well-known inventor.

Mining in Servia.

By H. L. Geissel.

More or less extensive deposits of all kinds of minerals occur in almost all countries of the Balkan Peninsula. With the exception of the petroleum industry in Roumania, and the emery industry in Greece, the mining industries of the Balkan states, however, are developed only to a small extent, chiefly because of a lack of enterprise, and a lack of capital. It was only during the last few years that a stronger impetus was given to the exploitation of the rich mineral deposits of Servia, and many concessions have been granted of late. We may at once state that in connection with this first development of the Servian mining industry, a demand for improved machinery and mining tools has been created, and American manufacturers should not overlook the opportunities offered to them for the sale of their goods, not only in Servia, but all over the Levant. If it is considered that the Balkan states proper—Turkey, Roumania, Bulgaria, Servia, Greece and Montenegro—imported in 1899 machinery and tools to the aggregate value of about \$10,000,000, of which almost nothing came from the United States, it will be apparent that these are markets well worthy of our closest attention.

There are convincing proofs that some of the Servian mines were worked on a most extensive scale in early times, and it is generally believed that in the fourteenth century these mines had attained such notoriety that they were not inferior in importance to those of the first European states. Since that time, however, they have continued to decline, and very little attention was paid to them until towards the first half of the nineteenth century.

The new era in the history of Servian mines began with the arrival of Baron Herder (an authority on mines), who came to Servia at the instance of Prince Milosch, in the year 1835. At this time the Servian mines had gone through such a long series of misfortunes that the population was not favorably disposed towards them, the chief reason for this being the failure of the Government mine of Majdanpek.

In 1878 several new mines were opened up, which caused considerable interest in mining circles, and this was followed by an improvement in Servian trade and industry, especially as regards mining products. Shortly after this the construction of a narrow gauge line of railway from the Vraska Cuka mine to the Danube gave a fresh impetus to the working of this mine by giving a new outlet for its products. In 1886 the State again began to work the Majdanpek mine, as it was considered essential to the interests of Servian mines generally that the chief government mine should be regularly worked.

Immediately after this some disputes arose in connection with the Kucajna and the Podgora or Podgorina mines, which were settled in favor of the State, and from that time foreign capitalists began to interest themselves in Servian mines. The first foreign mining company in Servia, "L'Industrielle Serbe," was founded in Brussels.

On the occasion of the Paris Exposition of 1889 the ore deposits at Kosmaj were examined, the government granting 80,000 francs (\$16,000) for this purpose, with the result that many new deposits of ore were discovered, and the old deposits were carefully explored. In the same year the government mining department laid down new regulations for the future working of mines in Servia. In consequence of the taking over of the Servian railways from a French company, which had previously worked them, the government wished to cease the importation of foreign coal, and determined to work the rich coal mines near Senje. In order to do this it became necessary to construct a railway between the town of Cuprija

and the said mine, the second railway line built in connection with these mines. The "Skupashina," or Servian Parliament, at this time began to show some interest in the development of the mines of Servia, and later large sums were voted for carrying out the government mining operations and for opening up new lines of railway.

In reviewing the Servian mining industries, we may classify the mines as private and state.

PRIVATE MINES.

The private mines include coal, lignite, quicksilver, silver, lead, zinc, and antimony. As already mentioned in the beginning, considerable concessions have been granted during the last few years, and it would fill too many columns to give an account of all the minor enterprises, many of which are worked without machinery by a few men. We therefore confine our review to the principal mines, fifteen in number.

Most prominent among them is the "Vraska Cuka Mine," or "L'Industrielle Serbe," a company founded in Brussels, with a capital of 7,000,000 francs (\$1,400,000). The mines are situated in the department of Crna Reka, in the district of Zajecar, near the village of Prilika. The coal belongs to the Lias, and is overlain by beds of clay and sand. The thickness of the seam is from 0.5 metre (0.55 yard) to twenty-five metres (27.3 yards). The mine is worked by three adit levels situated at a distance of thirty metres (32.8 yards), one above the other. The coal is of very good quality, chemically, but on being exposed to the atmosphere it crumbles. The company has, therefore, established a briquette factory near the mouth of the River Timok, and has connected this factory with the mines by means of a railway eighty kilometers (49 2/3 miles) in length, with a gauge of thirty inches. The briquette factory is equipped with the latest and best machinery for the manufacture of briquettes, and can turn out eighty-five tons daily. There are about 300 men employed at the mine and briquette works. The briquettes are taken to the Danube (Lower) where they compete with English coal.

Much less important coal mines are those known as the Dobra Sreca coal mine near the village of Vina, in the Zaglavlie district, the coal obtained from this mine being, however, of an excellent quality; the Podvis coal mine, near the village of Rgoste and Oresac, district Knjazevac. The coal of this mine too is of excellent quality. It is of a bright black color, with a conchoidal fracture. The price of the coal at the mine is \$2.75 per ton. The Kamenac coal mine is situated in the district of Podjana, near the village of the same name. The coal is of tertiary age, and is in reality a lignite; roof and floor consist of sand and clay. The Kraljevac coal mines lie in the districts of Alexinc, Bovan and Vakup. The mineral is a brown coal of tertiary age. The chemical composition of this brown coal is as follows:

	Per cent.
Carbon	54.83
Hydrogen	4.48
Oxygen and Nitrogen	20.77
Water	14.53
Ash	5.78
Total	100.39

It gives 4,029 calorides.

The Sisevac-Vrcic coal mine is situated in the commune of Beljan. The coal is of tertiary age, and in quality is similar to that of the state coal mine Senje. The Jeklov coal mine is owned by Josif Jekl, mining engineer of Petrovac. The Costolac mine, situated in the commune of Costolac, comprises forty-one mining fields. The mine lies close to the Danube, where some years ago, a quay was constructed for the purpose of shipping the mineral direct from the mine cars. There is also a school for children attached to the works. The coal of this mine is of a fair quality. The Dobra

coal mine, situated on the Danube, in the district of Gobulac, has the deepest shaft of any mine in the district. A narrow gauge railway, 1,640 yards in length, on the self-acting inclined plane system, carries the coal from the mouth of the pit to the landing stage, whence it is shipped to lighters. Latest reports are to the effect that this mine will soon be equipped with a new plant.

Of other private mines the Kucajna lead and zinc mine is perhaps the most prominent. The quantities of ore found vary considerably, for in some places there are pockets of ore 7,000 cubic metres (9,166 cubic yards) in size, while in others the nests of ore are only five centims (.3 cubic inch) in size. The minerals found are galena, lead oxide and cerussite, all of which contain some silver and gold, blende, pyrite, pyrrhotite, chalcopyrite, bornite, limonite, antimonite, arsenopyrite, etc. Near these mines there are large smelting furnaces for zinc and lead ores, but these have been idle for a long time. In 1886 the mine was fitted throughout with new machinery. The mine is situated near Kucajna, in the commune of Kujevo.

Another important mine is that known as the Avila quicksilver mine, the property of the Anglo-Servian Joint Stock Co., formed in 1889, with a capital of 4,500,000 francs. This mine is situated in the village of Ripanj, district Vraca, and has an area of forty-two mining fields. The quicksilver occurs at the contact of serpentine and limestone for a distance of two kilometers (1 1/2 miles) from the western side of the concession. The ore deposits are very rich. There are three shafts for connecting the different levels and for ventilating purposes. Additional shafts are now being sunk. In this mine rails are laid down in all directions to facilitate the transportation of ore. The new smelting works erected near the railway station of Ripanj are built in a solid manner. The principal markets for the output of these works are Belgrade and Vienna. The average yield of the ore worked is 1.80 per cent quicksilver; some deposits give as little as 0.2 per cent, and some as much as fifty per cent of quicksilver.

The Ripanj Quicksilver & Silver Mines Co. is a limited liability company, established in London.

STATE MINES.

The Servian state mines include copper, iron, coal, lead, antimony and zinc mines. Most prominent among them are the Majdanpek copper and iron mines. It can be assumed with certainty that they were worked even in the earliest times. The best information on the subject dates from 1719 to 1738, during the time of the Austrian occupation. We learn that at this time the production of copper at the busiest period amounted to 500 tons. In 1738 Majdanpek was completely destroyed by a horde of Bashibazouks. The greater part of the inhabitants fled to Hungary, some fled to the forests whence they only returned after the Turkish invasion, and the few that remained continued to work at the mines. The mines, however, were not again put into proper working order, and fell completely into decay. It was only in 1847 that the mines were reopened. From 1847-1849 Majdanpek had cost \$1,200,000, not including the unpaid labor from the surrounding villages, which was estimated at a further sum of \$600,000. Nothing more was done until 1860, when Majdanpek was concessioned to a French company. The preliminary expenses of forming this company were so great that when, in 1861, they were ready to commence operations they had not sufficient capital. The result was that the company became bankrupt in 1866, and the material which remained at the mines was smelted into copper for the use of the Servian war office. In 1863 another attempt was made to work the mine, and since that time the principal efforts have been directed to the production of copper, the iron production

having been almost abandoned on account of the bad quality of the iron. The enterprise had to be relinquished, however, after about a year and a half, and Majdanpek passed into the hands of an English company, composed for the most part of the French shareholders of the old bankrupt Franco-Serbian company. In 1881 the mines were taken over by the Government. The output during the twenty-one years from 1870 to 1890 amounted in round figures to 56,993 tons of copper ore, which produced 2,419 tons of pure copper, the value of which was 3,021,976 francs (\$604,904). The present production is some 350 tons per annum. There are about sixty machines in use representing altogether 540-H.P.

The principal State coal mine is that situated at Senje. The coal is heaped up into a coalfield which, speaking generally, runs from north to south, having as far as is at present known a length of thirty kilometers (18 2/3 miles) and a breadth of twelve kilometers (7 1/2 miles). The coal

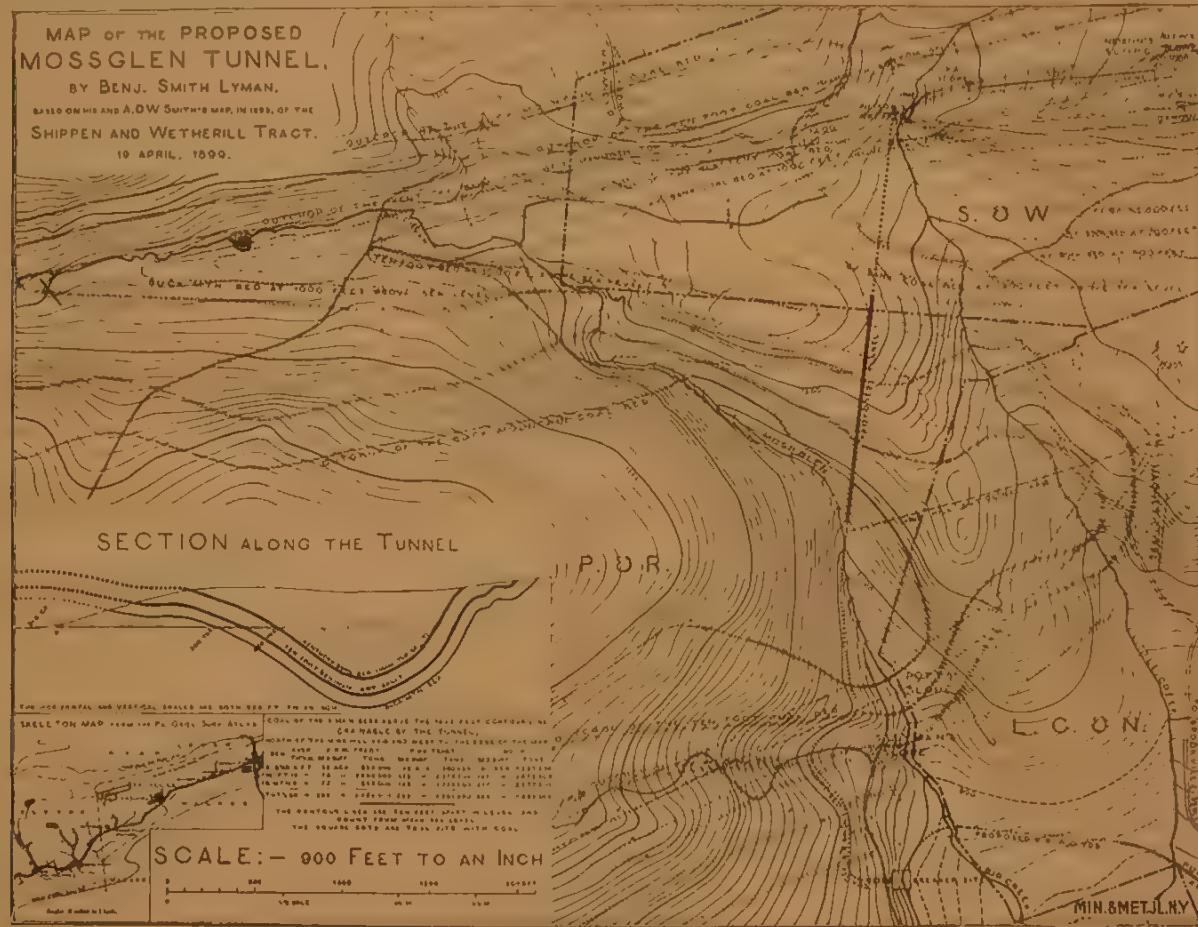
Importance of Topography in Geological Surveys.

By Benj. S. Lyman, Min. Engr., Geol.,
Life Member A. I. M. E.

The great value of topographical, or hypsometrical mapping in practical geological investigations is in general far too little appreciated, doubtless because it is not properly understood. Not only is such mapping extremely useful, and, indeed, at least in some rude form quite indispensable for displaying with any approach to completeness the situation and extent of mineral deposits; but it is, if possible, yet more absolutely necessary for measuring their cubical contents, or for answering many questions in regard to the methods of mining them; and, moreover, it is often the only possible means of determining their probable place of outcrop, and gives in many cases very precious indications of the otherwise wholly

are well-nigh obvious, and are generally admitted, even if not fully appreciated to their true extent.

It is hardly less plain that such a map is necessary in order to compute with any precision the probable amount, in cubic yards or in tons, of any deposits indicated upon it, taking into account their extent, as shown not only by the horizontal area underlain, but by the height of the outcrop at the surface of the ground and the depth reached by the dip—in a word, the superficial area of the deposits, to be multiplied by the average thickness, for cubic yards, making the tons calculable according to the specific gravity. Of course, the proportion of the whole amount that lies above or below a given drainage level, or other level, or accessible within a certain distance of a given shaft or drift, or within certain boundaries, can be reckoned in the same way. The depth of a slope or shaft at a certain point, or the length of a drift or rock-tunnel at another, for satisfactory mining, can readily be measured with



from Sanje contains little ash and moisture; its calorific power is high, and it has a moderate flame. It can be used for heating, forging, and smelting purposes. It is calculated that the coal seams above the lowest adit level alone can produce approximately 200 tons of coal daily. Every possible measure has been taken to secure the successful working of this mine. A briquette factory, with two presses and proper machinery to supply 200 tons of briquettes daily, was fitted up some years ago. This plant was designed at the well-known German "Humboldt" factory near Cologne. A narrow gauge railway connects the works with the Servian state railways.

Ccher state coal mines of less importance are situated at Aliksar and Misaca. Lead mines are situated near Kosmaj, and antimony mines at Podrina, but are worked only to a limited extent.

hidden geological structure. In short, topographical mapping is needful, not merely for tastefully and clearly setting forth the facts, but as a means for ascertaining them.

It is perhaps hardly necessary to spend many words in explaining how useful it is in the display of the facts; for it needs little reflection to convince anybody that only a map that shows everywhere the height of the ground can indicate with any clearness or precision at every point how deep below the surface, how steeply inclined, which way inclined, and how extensive may be the mineral deposits in question; and that, too, with due reference to the relative position and height of all the surface features that affect the possibilities of opening mines, draining them, erecting mine buildings, road-making and the like. Such advantages of topographical mapping

such a map, and could not be satisfactorily estimated in any other way. For instance, the place for the first shaft sunk in 1866 at the Caledonia mines in Cape Breton was fixed upon with the help of such a map; and it was reckoned by the map that it would be 180 feet deep to the bottom of a certain coal bed, dipping about one in ten, and when the map was made in 1863, not exposed nearer than three-quarters of a mile away. The depth turned out to be in fact 182 feet. Of course, rockbeds are not everywhere by any means so uniform in dip and thickness as to enable so close an estimate to be made, but a map of that kind is nevertheless of very great use as a guide.

Let us proceed, then, at once to the less generally understood benefits of the topographical method of working out the discovery of geological facts. Clearly a bed or vein of any mineral

with a uniform vertical dip would have its outcrop represented by a straight line on a map, no matter what variations there may be in the height of the surface of the ground. In like manner, on the map of a perfectly flat plain the outcrop of a bed or vein of any uniform dip would be indicated by a straight line. But if the dip be not vertical, and the surface of the ground be of varied height, evidently the course of the outcrop would not be straight. A straight line would indicate the position of the bed or vein at a certain level, but according as the dip is steep or gentle the bed or vein would, in a horizontal projection like a map, depart little or much from that line in rising to the outcrop at the surface of the ground. Consequently, on high ground the outcrop bends away from the straight line, and in low ground curves again towards the lower level. If the level line is itself a curved one, as in the case of a coal bed at the rising end of a basin or the sinking end of a rock-saddle, the outcrop at the surface of the ground of varied height will not be a parallel curve, but a more complicated one, even if the dip be uniform. But if the dip itself, as is usual in such cases, vary according to the elevation—that is, become gentler or steeper at a higher level—the position of the outcrop will proportionately vary. The topographical map makes it possible to take account of all these influences and to work out a more or less accurate result, according to the fullness of the information as to the direction and amount of the dip and as to the height of the ground.

If the position of the bed or vein at a certain level be marked by a line upon the finished map, the distance from that line to the outcrop at any other level is an indication of the steepness of the dip throughout that space. If the bed or vein be so marked at different equidistant levels, differing by, say, 100 or 1,000 feet in height, the distance of the lines apart indicate the steepness of the dip at any point, just as the steepness of the surface of the ground is shown by the closeness of the surface contour lines. In fact, the map becomes a complete geometrical construction of the surface of the ground and of the underground mineral deposit, showing the shape and position of both the surface and the deposit. The actual observations of the shape of the mineral deposit may necessarily have been fragmentary, but the graphic construction, perhaps with the aid of many trial cross-section diagrams, reveals the general shape that the field observations help to indicate, and in cases of doubt often shows what is the most natural and probable form. The sometimes curiously crooked outcrop lines so worked out are not mere fancy, but the result of painstaking elaboration of the intersection of the adopted most probable, if not certain, form of the coal bed with the surface of the ground.

But the mere shape of the surface of the ground in very many cases gives evidence of the underground geological structure, hidden though this be by the superficial disintegration of the outcropping rockbeds; for it must be borne in mind that the present surface is the result of wearing away through countless ages under the action of rains and streams aided by the disintegrating influences of the weather, air, moisture, changing temperatures and frost. Obviously some beds must resist these influences better than others can. Hard beds will be worn away less rapidly than soft ones and will, consequently, tend to stand up higher at last than less firmly coherent ones. Some whole groups of rockbeds or geological formations are much harder and more resisting than adjoining ones, and so tend to form mountains bordered by valleys in the softer formations. The fact first became especially noticed sixty years ago in the study of the geology of Pennsylvania by the State Geological Survey; because the effect there is strongly marked by large

groups of hard beds, separated by large groups of soft ones throughout wide regions that are concordant each within itself in respect to dip and other conditions, though differing markedly from one another in dip. The geologists of that survey observed also the peculiar effect of the dip upon the topography in the shape of anticlinal, synclinal or monoclinal mountains, and acquired great skill in recognizing the formations and the geological structure by the very succession and form of the mountains and valleys.

On a much smaller scale, too, the topographical effect of harder and softer beds is noticeable and a very helpful guide to the geological structure. Take, for example, the accompanying map of the Moss Glen Tunnel, not drawn, to be sure, for the present purpose, but capable of serving well as an illustration of the value of topographical indications of the geological structure. The rocks of the field mapped are in the upper part the lower productive coal measures, partly very hard sand rock and conglomerate, and partly softer shales and anthracite coal beds; and in the lower part the very hard Pottsville conglomerate, or Pennsylvania formation No. XII. The main features of the geological structure are most strikingly indicated, particularly by the topography of the western two-thirds of the map. There, on the north, the east and west valley of Big Creek lies in the hollow of a deep basin in the somewhat softer rocks of the lowermost part of the coal measures; while on the south, about the centre of the map, the eastern end of the great Mine Hill anticlinal brings up the very hard Pottsville conglomerate into a high east and west ridge, with its axis near the letters P. & R. To the north of the basin there is another much smaller, double basin, or pair of slight depressions, causing the small flat piece of ground at the northeastern corner of the map, and dying out gradually towards the west, so as to be perhaps scarcely noticeable beyond the middle of the map. That depression is known as a more decided basin in mine workings a mile or more to the east, and within the map has been proved by several trial pits.

Let us now look more in detail at some of the smaller features of the topography. Beginning at the two mine slopes near the northeast corner of the map, it will be observed that the outcrop of the Kentucky Bank, or Mammoth Top Split, coal bed, dipping about 55° southerly, is overlain at a couple of hundred feet to the south by material that forms a decided ridge, with a steep southern slope, and not far westward with a steep northern slope also. Indeed, the top of the ridge is marked here and there with boldly outcropping pebbly sand rock, and ends with a large high crag of hard coarse conglomerate, at Nelson's Breaker near Little Creek, 500 yards west of the mine slopes. The creek has cut across the hard rockbed, and westward the exposures of the rock do not recur; although the coal bed has been proved by several trial-pits to be in undisturbed position there, as confirmed also by provings of other parallel coal beds, mostly at points first ascertained by means of the mapping. Going still further westward, the hard underlying rockbed soon shows its presence by rising ground, which presently bends southward at the "spoon of the basin," where the six trial-pits, near the upper (eastern) surface of the rockbed, showed very gentle easterly dips. The hard rock, on reaching the southern side of the basin, near the southern corner of the S. & W. tract, bends eastward, and with a gentle northerly dip of about 20° forms a somewhat broad-topped ridge, with a steep rocky southern escarpment. That southern steep, however, is interrupted by a terrace where the softer Kentucky Bank coalbed crops out. There, among the blocks of pebbly sandrock fallen from the cliffs above, the very first trial-pit proved the

presence of the coalbed, much to the surprise of men who, without knowledge of the real geological indications of the topography, yet are apt to exaggerate the influence, or, as they consider it, the underground effect, of superficial circumstances, like bold, yet quite natural, not especially disturbed ledges of outcropping rockbeds. The hard rockbed continuing eastward and bending southerly, near the eastern edge of the map, round the sinking Mine Hill anticlinal, with very gentle dips near the axis, and exposed here and there in cliffs on the roadside near the east edge of the map, affects the topography, forming a hill, that is shown only in very small part within the limits of the map.

It must be remembered, however, that rockbeds are generally variable in character, thicker at one point than at another, harder in some spots than in others; at some places, as in the case of the hard bed just followed up, mere sand rock, at others pebbly with scattered pebbles, and again almost wholly made up of coarse pebbles, and accordingly variable in the power to resist the eroding agencies. Besides, the local strains and fissures or crushing caused by the folding of the rockbeds into basins and saddles must necessarily have made some portions more vulnerable than others. Furthermore, the steepness of the dip of a rockbed may by the consequent character of the outcrop make a difference in the ease of erosion. The eroding agencies, moreover, can work with greater effect in some places than in others; more powerfully in or near the channel of a stream, where the volume of flowing water is greater, especially at times of flood, than at the summit of divides between valleys, where there is only the falling rain water to wash away the rocky or earthy material. It must not, therefore, by any means be expected that a hard bed should make everywhere a uniform ridge, and a soft bed a uniform hollow.

Even more than the valley of Little Creek, the course of Big Creek, cutting across the Mine Hill anticlinal ridge of very hard No. XII conglomerate at the steep, narrow, wildly rocky Moss Glen, is itself a striking instance of a deep depression in what is mainly a high ridge caused by hard rock in anticlinal form. It would be difficult, or wholly impossible now to trace out all the precise causes of this local effect and show in detail exactly how it was probably due to the mere wear of the stream itself through many thousands, now, millions of years, having perhaps originally started in some fissures or weak spots occasioned by the folding of the rockbeds, and possibly been somewhat hastened by a former greater volume of water than the present stream. But we may confidently believe that the causes were of that slow-acting character, working through immense periods of time, and not at all like the instantaneous bursts of energy that the huge, confusedly scattered blocks of merely fallen, weather-loosened or frost-broken conglomerate suggest to the picnicking visitor, who has the impression that what he sees must have been effected within a few days or hours. It is that persistent, long-lasting, mostly uniform action that has produced topography in the main so closely agreeing with the geological structure and so trustworthy as a guide to its interpretation.

It may now be perceived how much more advantageous in the end is the topographical method of geological surveying than the more miraculous, more expeditious and more popular way of mere sagacious conjecture, simply stamping the foot on the ground and declaring with emphasis that this or that glorious state of things exists at a depth of 200 feet, and leaving the facts to be tested later by a diamond drill hole or other yet more costly means. Instead of by far more satisfactory and far less expensive trial-digging at an ascertained place of outcrop.

The Bethune Colliery Exhibit at Paris.

The award of a grand prix to the company and of three gold medals to as many of its managers by the judges at the Paris Exposition has attracted widespread attention recently to the Compagnie des Mines de Bethune. The company's recipients of the gold medals were M. L. Mercier, the general manager; M. Malatray, the underground manager, and M. Pirekher, the chief engineer for the surface works. For the illustrations from which accompanying cuts were made,

also by Coxe screens. Owing to the arrangement of carrying and picking belts each size can be loaded separately, or any desired combination can be made. The roller bar screens and the Coxe screens, that have been in operation for three years, have given every satisfaction; and a trial has been made of bearings made of oiled wood that have not as yet shown any appreciable wear.

SCREENING PLANT AT NO. 9 PIT

As the semi-bituminous coals of this pit are very friable, the screening plant was designed



THE BETHUNE COLLERY'S WAGON TIPPLER

and for the map, the following description of the mines of this well-known French company, we are indebted to an article in the Colliery Guardian.

The Bethune Company was one of the first to use compressed air in underground workings, having in 1875 started a Dubois-et-François compressor made at the Fives-Lille works. In 1882 all the pits were provided with compressed air, the compressors employed (in addition to those laid down at one or other of the pits by the makers just named) being the Dujardin compressors with large inlet and delivery valves, kept down upon their seats by springs, provided with jet injection; and Dubois (Anzin) compressors, with small Corliss valves for both inlet and delivery, kept cool by drawing in water through the inlet valves. A careful study of the working, yield and maintenance of these different compressors, as well as the information received as to others in use in the neighboring collieries, induced the company to adopt for its new installations a type that appears to unite all the conditions necessary for economical working and a high yield with a minimum expense for maintenance. The various parts are very strong; and, for better distributing the very variable efforts exerted by these appliances, the system in stages, or compound, has been adopted, with the result of rendering the working regular even in the case of a high speed and high expansion. Small Corliss valves are employed both for inlet and delivery; and from five to six kilogrammes (mean twelve pounds) of water are drawn in for each cubic metre (35.81 cubic feet) of air during the period of compression by pumps driven by the compressor engine.

SCREENING AND SIZING.

Screening and sizing have received a great deal of attention from the company during the last few years with a view to the putting up of a screening plant that shall, as far as may be possible, meet the requirements of consumers; and the plants at pits seven and nine constitute two distinct types that are followed by all the others. The screening plant of No. 7 pit, where the bituminous and coking coals are worked, is made double, so as to permit of screening the two varieties simultaneously, six sizes being made by the bar screens on to which the coal is tipped, and

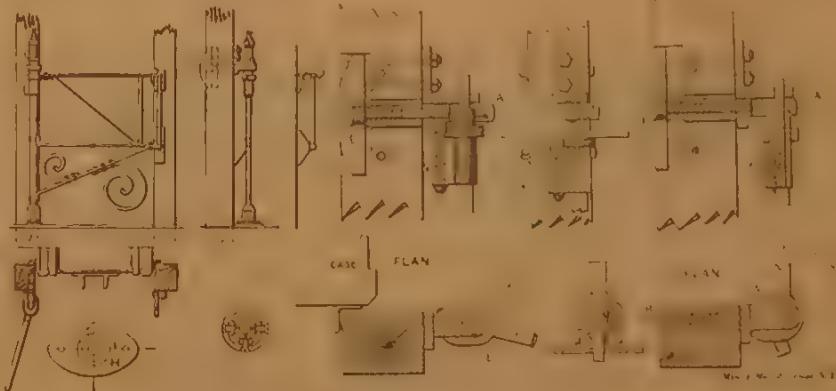
so as to avoid all causes of breakage so far as possible; and an arrangement of shaking tables, one above the other, has been adopted which classes the coal methodically, beginning with the large. The products intercepted by each perforated plate are delivered without fall on to the corresponding belt, while those passing through the holes are brought by a shoot forming part of the shaking table, and which moves underneath the picking belt, to the upper part of the next perforated plate. This arrangement has led to arranging the picking belts one above another, so as to give on to telescopic spouts for loading the classed coal on to wagons. Before reaching the spout these coals are passed over small shaking grids, which separate the small due to breakage during the cleaning, that is brought by two carry-

ing belts on to that of the "fines." In front of these grids there is a reconstitution belt, on which the various sized products are brought by means of rakes, and also delivered on to a fourth belt. The last shaking table has two perforated plates; and the products are sent, by means of shutters, either on to the fourth belt, or on to those for the "fines." It is also possible, by substituting for the second perforated plate one not perforated, to send the 0 to 50 mm. (2 in.) size on to the fourth belt, or a part of it only, the remainder

THE WASHING FLOOR.

The washing floor, for dealing with 100 tons per hour, was started in 1897, while the first bank of coke ovens was begun at the same time. The washing plant is divided into two parts, for permitting the simultaneous treatment of two varieties of coal, brought up in the company's fifteen-ton wagons, which are discharged by tippers of the same type as that illustrated in connection with the canal loading station. The coal, which is received in hoppers, is taken up to the top of the building by two bucket-chains, which spread it out on shaking tables from the following classifications: From 50 mm. (2 in.) to 7 mm. (1/4 in.), conveyed directly to the loading towers after having been picked on a traveling belt; 30 mm. (1 1/2 in.) to 50 mm., 15 to 30 mm. and 8 mm. (5/16 in.) to 15 mm., which sizes are carried along by water currents to the washers for treating the "grains"; (3) 3 mm. (1/8 in.) to 8 mm. and 0 to 3 mm., which are also carried along by water currents to the felspar boxes to be washed, or are conveyed, wholly or partially, to the loading towers direct.

There are three washers for "grains" in each portion of the plant; and the classification is effected by density in piston washers. The pure coal passes off with the upper current of water, while the shales and the "mixed" (coal and shale together) from the three washers are conveyed by a creeper and a bucket-chain to a re-washing tank similar to the preceding, the "mixed" being discharged into a concentrating cistern or loaded



SHAFT-CLOSING BARRIER, BETHUNE COLLERY

directly in a tower. The shales from eight to fifty millimetres, forming the bottom bed of the washing table, are drawn along by a water current into the tank that receives all the rubbish.

There are six "fines" washers for each portion of the plant; and they consist of double cases, in the hinder portion of which moves a piston that gives the water its upward movement. Gauged pieces of felspar, acting as valves, constantly draw along the shales to the bottom of the cases while the pure coal passes off with the upper cur-

rent of water. The first and second cage of each washer receive the shales; and the third the "mixed," while the pure coal passes into a tank common to all the washers. The "mixed" products of the third cage are re-washed in appliances identical with the preceding; and the shales are drawn along by a water-current into the rubbish tank.

The pieces of coal up to 8 mm. (5-16 in.) from each part of the plant are drawn along into concentration basins. An arrangement special to this plant permits of obtaining menus (small) of contents in volatile matter varying from fifteen to twenty-eight, or coals of the same contents containing various proportions of "grains" of different dimensions forming "fines" of 0 to 15 millimetres, 0 to 30 millimetres, 0 to 50 millimetres, 15 to 30 millimetres 15 to 50 millimetres, 25 to 30 millimetres and 25 to 50 millimetres (1 in. = 25 mm.), with sixteen, twenty, twenty-four, or twenty-eight per cent of volatile matter. The washed products are loaded by means of trap doors underneath the storing towers into railway wagons, while the rubbish is sent away by Decauville trams or ordinary wagons. There is a laboratory where an analysis can be made of all the coal arriving, and of all the fuel (coal or coke) before being sent off in execution of orders, while it also serves for testing all the raw materials received by the company, the number of analyses made daily varying from 200 to 250.

RAILWAY WAGON TIPPLER.

During the first year of working its concession the company's attention was turned to the economical sending away of its coal by water. At first the mine tubs were simply tipped into the canal boats; and subsequently railway wagons were discharged by the shovel into trams that were tipped into wooden hoppers for lessening the height of fall. In 1878 the engineers, after profound study of the various methods of loading, decided to adopt the Anzin tippler, in which the force of gravity is utilized, not only for tipping the wagons, but also for moving them along over all the lines of way. Two tipplers are erected on one side of the dock, each capable of loading 120 tons per hour. The full wagons arriving from the pits are drawn up the gradient by locomotives being shunted if necessary on to a series of lateral sidings; and then each set is brought to the tipplers. The empties run down the falling gradient, the movement of the wagons being thus effected with a minimum of expense. The first tipplers had the disadvantage of working too sharply, which was, however, to a great extent if not entirely counteracted by the use of hydraulic brake.

In 1890 the differential counterweight was replaced by a differential pendulum with an hydraulic brake; and the tipplers thus transformed, that give thorough satisfaction, have, since 1896, permitted of tipping indifferently the old ten-ton wagons, and also the company's new fifteen-ton wagons, made entirely of iron or steel. These tipplers, shown by the accompanying side and front views, work through variation in the position of the system's centre of gravity, which is on one side the axis of rotation when the wagon is full, and on the other when it is empty, this being brought about by an eccentricity in the centre line of the track with reference to the axis of rotation, and also through the effect of a counterweight, fastened rigidly to the platform provided with two trunnions and constituting the tipping arrangement. The motion is regulated by a hydraulic brake consisting of a cylinder in which moves a piston connected with the platform by a rod, it being possible to make or suppress communication between the two faces of the piston. This brake also serves to hold the system fast at its extreme positions, the piston acting on an incompressible liquid. The wagon floor is inclined thirty-five degrees, and the coal passes off without any direct

fall to the bottom of the boat by a hopper prolonged by two movable shoots. A mechanical towing plant permits of moving the boat, without any labor being required, in either direction in front of the hoppers.

BARRIER FOR CLOSING SHAFT.

The automatic barrier got out at the Bethune Colliery is shown by the accompanying elevation (in the position of closed), side views and plan (in the position of open), and also by several details, the curved arrows in the enlarged plans indicating the direction of opening. It can only be opened when the cage comes in front of the landing that it protects, the barrier closing of itself and becoming locked directly the cage is moved away from the landing. The arrangement consists in an eye, A, moved by the cage on encountering the push, B, and which is traversed by the upper part of the hinge-pin, C. The engagement is effected by a recess, D, in the inside of the eye, and which receives the tenon, E, in one piece with the hinge-pin of the barrier, this being the closed position. When the cage comes opposite a landing, it acts on the push B, moves the interlocking eye A, and frees the tenon E, thus releasing the barrier. While turning so as to open, the barrier rises on the helicoidal path, H, that surrounds the bottom of the hinge-pin. The barrier rises on the helicoidal path, with the aid of three small rollers, G, until it is held open by a spring latch, V, engaging in the catch R that forms part of the eye A, this being the open position. When the loading operations are finished and the cage is moved away from the landing, it leaves the push, B, thus releasing the latch, V, when the barrier, in obedience to the action of gravity, turns on its hinge-pin, descending the helicoidal path H and, at the moment of the barrier's closing, the eye A, owing to the spiral spring in connection with B, engages with the hinge-pin, and again keeps the barrier in the closed position.

Coal in the Arctic Regions.

To obtain fuel from the arctic regions seems almost a paradox, says a writer in the London Standard, but it is reported that good seams of coal have been found on the western side of Spitzbergen, and are to be worked on the most approved business principles. That carboniferous rocks existed in the island has been known for some time, but during the last summer experts were dispatched from Norway to ascertain whether the mineral was sufficiently abundant and accessible to be worth working. Their reports are most favorable. Good furnace coal has been found in Green Harbor, on the south side of the entrance of Ice Fjord, which pierces so deeply into the western flank of the principal island that the latter is almost cut up into three parts by the meeting of inlets from opposite coasts.

At another place in the same fjord three of the seams are from six to nine feet thick, and as they are above sea level must crop out at the surface. The larger and eastern part of Spitzbergen is more or less a plateau, and the strata are horizontal, ranging from the period anterior to the carboniferous to that in which our chalk was deposited. The western part is mountainous, and consists of older crystalline rocks, but uplifted parts of these sedimentary strata here and there rest upon them, as is the case where these seams have been discovered. In such circumstances, the fields are likely to be limited in extent, and the seams may be tilted at high angles, or broken up by faults. Still, as the coal can be worked by adits, its accessibility and the consequent economy in labor will be a compensation. These discoveries make it highly probable that larger, and perhaps richer, fields exist in the eastern part of the island which, however, will be less easily reached.

The effect, direct or indirect, of the Gulf Stream

opens the west coast of Spitzbergen in summer, but the other is more difficult of approach. It is stated that even in the sheltered Ice Fjord the coal cannot be shipped directly from the land and the piers must be removed before winter, during parts of which work will have to be suspended. But when the coal has been followed for some little distance from the surface, there will be nothing to prevent the mineral from going on even in December. The ground, no doubt, is permanently frozen for a considerable depth, but the temperature will rise steadily as the distance from the surface increases, and will be uniform. After a while the mine will be more comfortable than any house. As it is, the party will winter in the island from the first, and the longer they can work the more healthy they will be. But Spitzbergen may not be the only Arctic island in which coal occurs, though perhaps it is the most favorable for commercial purposes. The fuel may be found in Franz Josef Land; beds full of fossil plants occur near Elra Harbor—of later date, indeed, but in rock which elsewhere occasionally produce coal. From Nova Zembla Colonel Freiden brought back specimens of limestones which experts assigned to an age very near that of our English coal beds, and other localities could readily be named. But these masses of fossil vegetable matter indicate curious changes in the climate. Nowadays nothing bigger than the stunted Polar willow grows in Spitzbergen. Even in the extreme north of Norway the hardy birch is dwarfed. Yet these ancient plants formerly almost rivaled forest trees, and the change was late in coming. A temperate climate existed as far north as the seventeenth parallel, and in Greenland beds of brown coal were formed even in the Tertiary era. At that time the plane, the magnolia and the vine flourished in the latitude of Disco Bay.

First Electrically Equipped Lead Mine.

The St. Louis Smelting & Refining Co. of De-
luge, Mo., has just completed what is said to be the first electric power and lighting plant to be used in equipping a lead mine. Many coal, copper and gold mines are being run by electricity, but it is asserted that the St. Louis company is the first to use electricity in running a lead mine. The installation was made under the direction of Alexander Anderson, representing Floy & Carpenter, consulting engineers of New York City. The plant is thought to be one of the best specimens of economy and efficiency in the country. Of not less interest than the installation of electrical machinery is the mining machinery plant now in place in the big mill. The mill is built in four sections and in each section is a complete set of jigs especially built of cast iron by the Gates Iron Works. In each section there are two crushing rolls of sixteen tons each and one of eight tons, also built by the Gates Iron Works.

A main line jack shaft runs the full length of the mill. It is belted to individual shafts with clutches for driving each section, and was supplied by the Hill Cutlch Co. The mill is equipped with two large settling ponds from which the water is taken by two triplex Worthington pumps driven by a rope drive from the main shaft. When running full capacity the mill treats 1,000 tons of ore daily, each section contributing 250 tons to the total. The three slime tables provided in each section were made by the Gates Iron Works. In the entire mill there are 178 jigs or forty-four for each section. All of the structural work for the building comes from the Shiffler Bridge Co. of Pittsburg. The engines and compressors are of the Flier & Stowell make, and the Babcock & Wilcox Co. supplied the boilers. R. D. O. Johnson is the superintendent of the plant, his assistant is Charles Schwartz, and H. M. McChesney is the general manager.

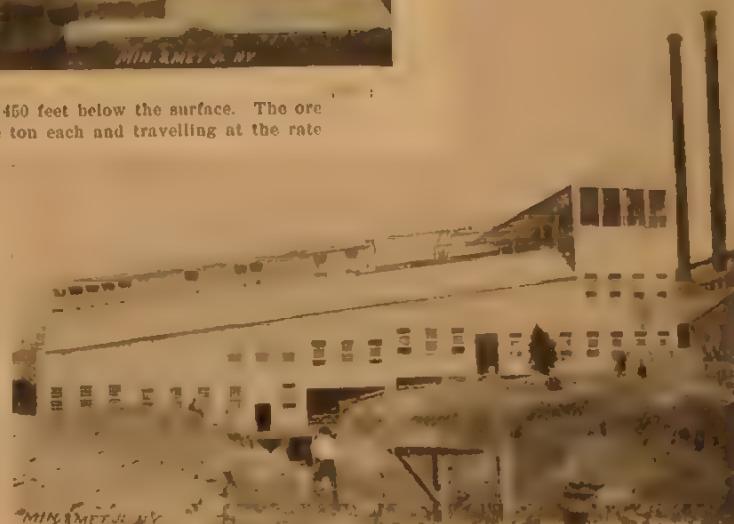


The mine workings are now about 450 feet below the surface. The ore comes to the top in cars holding one ton each and travelling at the rate of 300 feet a minute. It is dumped on the grizzly bars from which the smaller pieces fall below into a bin, while the larger ones are fed into crushers. After the ore is crushed it drops into another bin from which it is carried by a belt conveyor to the large bins in the main mill. From these bins it goes to the crushing rolls.

At No. 2 mine is the centre of the distribution of ore. A trolley line a mile long connects No. 2 with No. 3, and another a half mile long joins No. 1 and No. 2. It also meets the main line of the Mississippi & Bonne Terre Railroad. There are in all three miles of single track, with oak ties and sixty-pound rails. There are two trolley wires overhead, positive and negative, because the current is used in the mines for lighting and power, and the danger of grounding would be great with a single track line and rail return. General Electric No. 00 grooved trolley wire is used throughout, as are General Electric standard fittings and suspensions, with the exception of the crossings which had to be especially made because of the proximity of the two trolley wires. Twenty-ton locomotives equipped with air brakes and double trolley draw the cars. The locomotives draw the ore to the central storage bins from the mines, take the waste rock from the mill and the concentrator from the mill to the railroad siding, as well as the coal from the railroad to the power house dump. One feature of the plant is a machine shop run by a 10-HP. electric motor, and a carpenter shop and saw mill run by a 16-HP. motor. A triplex pump at the river 3,000 feet away from the mill is run by a 50-HP. motor. This pump delivers 1,000 gallons every minute for use in separating the ore. Power for the entire plant comes from the central power house, where there are found four 300-HP. Babcock & Wilcox water tube boilers and in the engine room one 850-HP. cross-compound condensing Corliss engine, direct connected to a 250-KW. 500-volt compound-wound generator; the balance of the power furnished by this engine drives the jack shaft in the mill. There is also a 350-HP. cross-compound condensing Corliss engine, direct connected to a 250-KW. compound-wound generator and a cross-compound condensing tandem Corliss valve air compressor, capable of compressing 250 feet of free air per minute to 100 pounds per square inch. The compressed air is used for the rock drills at the mines and the signals overhead. There is also a chloride storage battery of 250 fifteen-plate type "F" cells, a booster with motor, direct connect-

ed, having a capacity of regulating to the extent of 280 amperes on a variable load, having momentary fluctuations. The switchboard is constructed of blue Vermont marble, and is provided with quick-break switches and magnetic blow circuit breakers. There are two generator panels, three feeder panels and two storage battery panels.

The storage battery gives out from seventy to eighty per cent of fluctuating load, namely, when a hoist or locomotive starts and maintains an absolutely constant voltage at the main bus-bars in the following way: The variable load bus-bars are not connected with the main bus-bars except through the booster's series field when in regular operation. The series windings of the booster fields are wound in opposition to the shunt field windings, and consequently when there is a call for current on the variable load bus-bars, the current coming through the booster series coils automatically weakens the fields of the boosters (which are excited from the main bus-bars) and allows the current to feed out from the storage battery to the line in parallel with the series connections; the percentage of current required from the storage battery being regulated by the shunt fields of the boosters, so that when the load goes off, the proper proportion of the current will be boosted back into the storage battery and keep it fully charged ready for the next variable load call. A three-wire connection is made for arc and incandescent lighting positive and negative leads being taken from the main bus-bars, and the neutral from the storage battery, as shown in the diagram of connections. This gives 250 volts on a side. General Electric enclosed arc lamps are used singly across the 250 volts, and 250-volt incandescent lamps in the same way. The regulation is so close that no appreciable variation is noticed in the incandescent lighting at night, when all machinery is running. The current for each circuit is fed through a Thomson recording watt-meter; the total output is registered by one large meter connected to the main bus-bars.



The General Electric Co. furnished all the dynamos and motors, and the Electric Storage Battery Co. supplied the storage battery



AN ELECTRICAL LEAD-MINING PLANT.

Fig. 1.—Interior of Power House; Laying Foundations for the Machinery. Fig. 2.—View of the Mill. Fig. 3.—The Engine Room.

FIG. 3

The Principles of Mining Law.

By Charles J. Alford

Much of the dissatisfaction with modern mining law appears to be caused principally by two fundamental mistakes. Firstly, the hasty, ill-considered introduction of regulations into a country for which they are not suited from another of totally different conditions; and, secondly, the retention of laws and usages which were necessary in earlier times, but which the changed conditions of a progressing country no longer require. As an example of the first of these may be quoted the mining laws of the British South Africa Co., and of the second the Claim and Warden System of the Australian Colonies.

Mining law, like all other law, exists and should be framed for the collective good of the community of all classes alike, and those laws which act unduly in the interest of the working man and place upon capital too onerous burdens are as detrimental to the true interests of a community as any which may act in an opposite direction. In these days of constantly increasing pressure of competition, combination and the employment of capital are becoming ever more and more necessary in mining, as in every other industry, and the need of the individual independent miner and prospector, with other workers of his class, recedes more and more into the background, and gives place to the capitalized corporation; yet how few of the modern mining laws appear to recognize this—the small "claim" still holds its place, with the little pottering fees for prospectors' and miners' licenses, and titles are made to depend upon the digging of a few small holes, or, worse still, on the constant employment of some certain number of men, whether their work be necessary or not. A dawning glimpse of the true situation appears in some mining codes in regulations for the amalgamation of claims, but this is only a cumbersome and expensive method of passing on the ground to a capitalized corporation, which end could be much more easily arrived at by granting it to the corporation in the first instance without the intervention of the private prospector.

Analogous cases to those of which the author has had repeated experience will doubtless occur to the minds of many members of the Institution. How often in the colonies is a mining property, which would require a capital of £50,000 for its adequate development, taken up by a few working men who probably could not raise £500 among them for any purpose, with the result that no scientific system of mining can be carried out or necessary machinery purchased. Consequently, after a few months of struggling work, all the available mineral in sight is taken out to pay current expenses, and work ceases, leaving what might have become a paying mine a wilderness of holes, in which nothing can be seen whereon to base an encouraging report for continuing operations. "Paying from the grass" too often means stopping work not far below it. Another frequent case is one where the prospector acquires a mining property without having either the means or the intention of doing any serious work upon it, and then, holding on to the property by some subterfuge, waits the coming of any speculative individual who will give him an absurd price for it in order to pass it on at a further largely augmented price to a company whose capital, in order to pay these totally unnecessary demands, must be such as to preclude the possibility of payable working.

Alluvial gold mining is naturally the work of the independent individual miner, and its value in attracting a population to hitherto unpopulated countries is certainly very great; but to a country generally this appears to be its only value, as royalties or rents of alluvial claims are always

difficult and often impossible to collect, and the riches obtained on gold digging are soon dissipated. It is not necessary further to discuss this subject here. As the more remote corners of the world are becoming quickly opened up the chances of discovering important alluvial diggings near to any important centres of civilization pass away, and with them the necessity for considering the laws which were framed for their regulation. We shall more usefully occupy our time in considering those which apply to the mining of metalliferous minerals in veins or other analogous deposits.

An analysis of the mining laws of the world shows a grouping of the principles of their construction under two great primary heads: (1) That under which the owner of mining property, be that owner the State or a private individual, has the right to grant concessions of such mining property to individuals or corporations at discretion. This, for the sake of convenience, we will call the "concession" system. (2) That under which any individual has the right to locate, on discovery or otherwise, certain limited areas of mining ground, and, under certain conditions, to hold, work, or deal with the same. This we will call the "claim" system. The concession system had its origin in ancient days in the rights of kings and the feudatory lords to the mineral products of the ground, and to the disposal of them, and it prevails at present, in a more or less modified form, under all the ancient civilizations of the world. Public attention has of late years been so much centered on the newer countries of the world, where the claim system is in use, that some persons may be surprised to learn that more than five-sixths of the mining areas of the world are worked under concessions. Its great advantage is that as the state or other owner of the ground has the right to grant or withhold mining rights at discretion, they are usually only granted to those who have means to do good work, and the cases before described in connection with the workingman and mine owner do not occur. The claim system originated in the early days of mining in the Western States of North America. Great numbers of energetic men in the early years of the present century rushed to the alluvial fields of California, and later on to those of Australia, where for the sake of public peace some arrangement had to be made on the spot to determine the ground which it was allowable for a man to hold, and the conditions under which he could hold it. Hence arose the "claim." Then the necessity for a controlling power close at hand gave rise to the "warden," with his summary powers of confiscation and protection. As the alluvial mining waned, and was succeeded by vein mining, the system was continued, with some modifications, until upon it grew up the present mining law of the United States, from which several other modern codes have been more or less copied.*

Two Dollars Until January 1, 1902.

Notwithstanding the improvement in MINING AND METALLURGY, the illustrated special descriptive articles it will publish, and the increase in the number of pages, a copy of the paper will be sent to any address in the United States, Canada, or Mexico from receipt of the subscription until January 1st, 1902, for \$2. This includes postage and the changing of addresses as often as desired. Subscription to foreign countries including postage, \$3. This low rate is made to considerably increase the circulation. It is hoped that those not already subscribers who receive a sample copy of this issue will send in their subscriptions promptly, and get the full advantage of this offer.

*Extract Transactions Inst. M. M., London.

Paris Exhibit of the Copper Queen.

Among the exhibits of American mining companies at Paris none attracted more attention or received greater honors from the judges than that of the Copper Queen, the Detroit and the United Globe mines, all of which are controlled by Phelps, Dodge & Co. of New York. The Copper Queen Consolidated is far and away the leader in the group mentioned. Its present annual production is 40,000,000 pounds of copper. That of the Detroit mine is 18,000,000 pounds, and that of the United Globe mine is 6,000,000 pounds. The copper Queen Co. owns the Arizona & Southeastern Railroad, a standard gauge railroad sixty-two miles long connecting the mines with the Southern Pacific Railroad at Benson.

In the description of the Copper Queen prepared for the Exposition, it is stated that at the Bisbee group the ore occurs in irregular masses in carboniferous limestone, the profitable ores being confined to series of beds which do not exceed 600 feet in thickness. The ore masses are not only variable in size, but they follow no appreciable order in their deposition. All the surface ores have been converted into oxidized compounds. In parts of the mine alteration from sulphides to oxidized compounds has taken place to depth of nearly 600 feet, while in other sections heavy unaltered sulphides of iron and copper are found at 200 feet from the surface.

The oxidized ores in the only large outcrop which revealed the hidden treasures of the mine are found in association with calcite, while the deeper oxides are usually found with limonite, and occur sporadically in large masses of ferruginous clay. The richest azurite and malachite are found directly in contact with or near the limestone. The intermediate product, between unaltered sulphides and oxide ores, is a black oxysulphide of iron and copper.

One section of the exhibit at Paris showed the association of the oxidized copper with the oxides of iron and manganese and with clay and calcite, also the progress of alteration from pure sulphides of iron and copper through black oxysulphides to completely oxidized compounds.

The Copper Queen's ores come from over twenty claims from a subterranean area of about one mile by three-quarters of a mile.

The description of the exhibit distributed at Paris says concerning the treatment of the Copper Queen's ores:

"By mixing in proper proportion oxidized and sulphide ores, a matte of about fifty per cent of copper can be obtained from the cupola furnaces without preliminary calcination of ores. This is the grade of matte, which, considering the local cost of converter lining, can be most economically concentrated in the Bessemer converter. The matte from each of the four cupola furnaces is collected in large tilting wells, placed in series of two to each furnace, from which it is poured into a ladle operated by an electric crane. This transfers the still molten matte from any one of the four furnaces to any one of the four Bessemer converters. The charge of matte is blown under a pressure of eight pounds to the inch to metallic copper of about ninety-nine per cent. The operation is conducted in two stages. During the first the matte is concentrated to white metal of about 78 per cent, through the oxidation of the iron and part of the sulphur. The converter is then tilted; the blast is turned off, the slag, formed from the oxidation of the iron and the siliceous lining, is skimmed; the blast is turned on, the converter is restored to position, and the charge is rapidly and completely reduced to metal. The lining material for the converter usually available is valueless, but Mexico supplies a certain amount of auriferous



Open-Cut of the Copper Queen Mine.

and argeniferous ore, with the requisite proportions of silica and alumina."

In connection with the foregoing description of the Copper Queen and its exhibit at Paris, the following from a paper recently prepared by Dr. James Douglas of the firm of Phelps, Dodge & Co., and president of the American Institute of Mining Engineers, is of timely interest:

The Copper Queen mine has become famous for its beautiful specimens of carbonates, both malachite and azurite. The malachite is never found in such large and compact masses as to make it

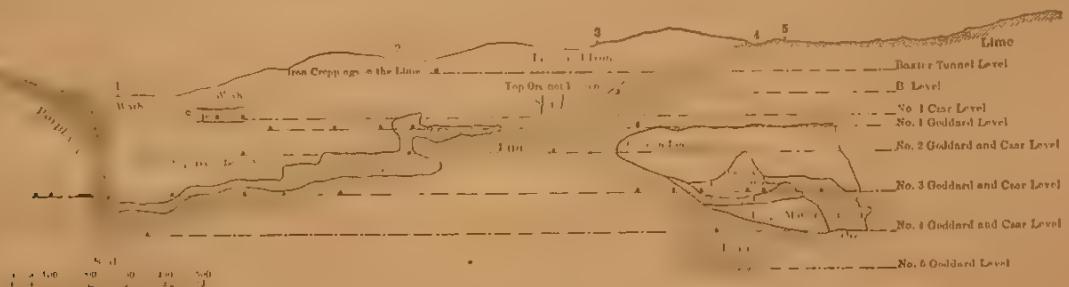
ite, also, usually occur near limestone, but preferably in the manganiferous, clayey gangue. The oxidized copper ores, however, which are mined in economic quantities, consist usually of cuprite and carbonate, disseminated through limonite; or of carbonates, chiefly of the green variety, in streaks or crystals scattered through ferruginous or manganiferous clay; or of minute particles of metallic copper, with more or less cuprite crystals, disseminated through yellow clay. These yellow clays are generally more distinctly bedded than the masses of red and black clays which carry the highly oxidized copper compounds. Masses of any considerable size of native copper are found almost exclusively, not at the surface, where the oxidizing agencies have been most active, but in the deepest layers of the large ore bodies, where apparently some reducing agent has been more actively at work than elsewhere, and where the ore is furthest removed from atmospheric interference. On the sill floor of the 300-foot level (at the bottom of the great southwest ore-body already referred to), native copper was abundant in masses, some of them of several hundred pounds in weight. The surface of the native copper lumps and masses is always more or less perfectly crystallized, as of course is the case in those mines where all the secondary copper ores were deposited slowly from the dissolved constituents of the original sulphides.

While selected specimens of the oxidized ores carry a very high percentage of copper, the percentage in the ore as actually mined is much low-



Selected in a Cove in the Copper Queen Mine.

warning is given. The tendency of the clays, under this pressure, is to rise, and therefore it is impossible to maintain a perfectly level track in the permanent ways. At the same time the walls of the drifts are either forced out of line by lateral pressure from one side or the other, or the drifts are contracted by the irresistible pressure, from all sides, of the swelling ground. Hence it is impossible to use underground, the most economical modes of traction. The stopes can be held up only by timbering in square sets, and the face of the stopes can never be safely broken down ahead



CROSS-SECTION NO. 24, COPPER QUEEN CO. MINING CO.

commercially valuable for decorative purposes; besides, occurring generally in thin botryoidal masses, it is usually streaked with manganese, which detracts from its purity. Its most striking mode of occurrence is in geodes, which are lined with velvety crystals of the same mineral. These hollow spheres, the walls of which are composed of concentric layers, are rare, but when found, are usually in nests imbedded in soft, wet, ferruginous or manganiferous clays, such as constitute the gangue, or "ledge matter," of nearly all the ore; and they occur at no great distance from a limestone wall or partition. The slabs of azur-

er, inasmuch as the particles of ore proper are associated with clays or limonite; and these cupriferous clays or limonites are themselves embedded in vastly larger masses of clayey ledge matter, absolutely barren of copper. The approach to the so-called ledge matter, when drifting through limestone, is generally indicated by a softening of the rock and a gradual replacement of the lime by silicates of alumina. A series of analyses taken from a drift in the eastern section of the mine, as an ore body is approached, indicate the gradual change from unaltered limestone to clays, involving a decrease in lime from twenty-four per cent to 0.33 per cent and an increase in alumina from 2.20 per cent to 16.9 per cent.

The difficulty of extracting the comparatively small masses of soft ore from large masses of plastic clay is very considerable. The whole hill is in a state of ceaseless movement. The comparatively shallow capping of limestone is fissured to the surface in all directions, and the lateral strains on the partitions of limestones which separate the masses of ledge matter, when large stopes are made in them, cause these partitions to yield. The slag dump in the valley east of the hill rests on detritus, beneath which is ledge matter, and is a source of considerable annoyance in the mine, as its pressure is continuously squeezing up the ledge matter in the eastern stopes of the mine. And so soft is the ledge matter which is under this valley, that concave-shaped caves extend to the surface from the stopes through 80 to 100 feet of barren clay, but fortunately the movement of ground is slow, and ample

of the timbering. The yield of this class of ore is about seven per cent, after rough selection in the stopes, where about one-half the total material broken is rejected. To supplement the deficiency in filling up the stopes, barren ledge matter from exploratory drifts is used. Though the timbering of worked-out portions of the stopes is thus enforced, so violent is the movement of the ground that, when an old stope is drifted through the old timbers are found upset and dislocated or crushed into chips. The size of timbers usually employed in square sets is ten by ten inches and twelve by twelve inches, and the most available



Slag-Dump East of Copper Queen Hill.



In the Bessemer-Pit.

source of supply is Puget Sound. About thirty feet, board measure, is buried in the mine to the ton of ore extracted.

A notable quantity of oxidized ore is also obtained from narrow irregular deposits between limestone walls, or from still more undefined boulders, which cement together limestone boulders, large and small. These boulders are generally superficially gnarled and corroded, as well as decayed to a depth of several inches, and they and the ore entangled among them are never situated at any considerable distance from the solid containing limestones.

The depth to which decay of ore has extended from the surface is very variable. A very large body of sulphide ore was struck on the 200-foot level, and yet in other sections of the mines the ores partially oxidized at the lowest depth at which ore has been encountered, namely, 570 feet below the collar of the Holbrook shaft. Yet below the 300-foot level, completely oxidized ores became scarce. The furnace mixture, for years before the company abandoned the making of bars direct, yielded a certain quantity of matter, and the copper bars were debased by a notable percentage of sulphur. The depth to which atmospheric agency reaches is, of course, determined largely by the permeability of certain rocks to the insensible flow of water through their pores. The compact carboniferous limestones, however, in which the Copper Queen mine occurs, permit the passage of atmospheric agencies to considerable depth, rather through the fissures and joints (expanding occasionally into caves), by which they are reticulated, than through the pores of the rock. An interesting phenomenon in the West, where the climate is so extremely dry, is the great depth to which roots will strike down through rock-fissures in search of moisture.

The sulphurites in these limestones occur in layers of various thickness and solidity. When solid and thin, they are generally partially oxidized, and are rich. Two very large compact masses have been encountered, and in part explored. The largest apex on the 200-foot level has been traced to the 400-foot level, and a string of stopes nearly 500 feet in length has been opened upon it; but the profitable ore bears only a small proportion to the whole mass. Roughly speaking, the mass is enveloped in a shell of oxysulphide, and streaks of similar black copper ore of good grade intersect it; but the core consists of compact blausulphide of iron, very lean in copper. The same condition holds good of most of the large iron-pyrites masses the world over, where oxidation is occurring; and, therefore, while estimates of quantity can generally be easily made, certainty as to value is more difficult to reach.

Stockholding Coal Miners.

An application has been made in Pennsylvania for a charter for the Pittsburg Coal Co.'s Association of Pittsburg. The charter is novel in many respects, mainly as showing the purpose of the organizers to bring together into one organization all the employees of the Pittsburg Coal Co., numbering about 25,000 men, and making them stockholders in the company. It is believed that the effect of the arrangement will be to promote the spirit of thrift and saving among the men and to secure their co-operation in keeping the company free from the losses and ill-feeling often engendered by labor troubles.

An official statement of the promoters of the new association says, among other things, that the organization is formed for the purpose of encouraging and assisting employees of the company to invest their savings in the preferred stock of the company, under certain prescribed rules and regulations. Each employee, whether he be located

in the offices or at the mines, will be allowed to subscribe for shares of preferred stock, on which he will agree to pay monthly or semi-monthly payments at the rate of not less than \$1 a share. These subscriptions will be invested in the preferred stock, which will be purchased on the open market by officers of the association. Any balances unexpended by the association for stock will be deposited with the treasurer of the company, and will bear interest at the rate of five per cent per annum. The interest thus earned, as well as the dividends earned by the preferred stock, will be applied on the purchase price of the stock until it is all paid for, when it becomes the exclusive property of the employee.

It has been arranged also that subscribers who want to pay more than the stipulated amount a month can do so, and the benefits will accrue with proportionate rapidity. Subscribers who fall behind in their monthly payments will be allowed to make up the payments as they can under reasonable conditions, while employees of the company who leave the employ of the concern are privileged to continue the payment on the stock subscribed for until it is all paid up, or, if they so desire, may withdraw their money, with accrued earnings at any time. Another provision made is that where an employee is subscribing toward a number of shares and wishes to withdraw he can have all he has paid apply on shares equal in amount to all the money paid in and held them.

The incorporators state that the plan has the sincere co-operation of the officers and directors of the corporation, and the plan will be encouraged by them as much as possible. It is the desire of the promoters of the association to get all thrifty employees in the big corporation to take on the dignity of stockholders and become personally interested in the welfare of the concern. In other words, the scheme will make the big coal combine as nearly a co-operative company as is possible. Other features will be added in the near future. One will be an accident and death benefit feature. At present, it is practically impossible for a miner to take out life insurance of any kind, because of the risks he runs.

In addition to the incorporators the association will have an advisory board to assist in the management of the affairs of the concern, the members of which will be selected from the various departments of the company and its auxiliary companies. This board has been selected for the first year and consists of the following: W. W. Osborne, William McCune, J. W. Blower, N. F. Sanford, Benjamin Fereday, W. A. Dinker, S. H. Robbins, A. W. Horton, J. T. Connery and C. Dixon.

A Mining Survey.

By J. A. Knight.

In your issue of November 15 you publish an article by J. F. Wilkinson of San Francisco, Cal., entitled "A Mining Survey." While it is very interesting to note the method employed by Mr. Wilkinson to obtain a high degree of accuracy, yet it is quite essential to know the extent of the survey distances, of his courses, number of set-ups, etc., in order to judge whether such careful methods were really necessary or not. When one stops to think that an error in angular measurement of one second means less than half a hundredth of a foot (one-sixteenth of an inch) in a traverse of 1,000 feet, it would hardly seem that the end would justify the means, unless the traverse were a long one, greatly exceeding the above figure, which the article does not seem to indicate.

Only a few months ago I raised the Lincoln shaft, six by ten, from the 9th level to the 8th

on timbers, with an error of less than 66 foot, and this required the running of three courses on the 8th level, dropping wires less than three feet apart down a winze, and then four courses on the 9th level to get back to the shaft. Three independent surveys were made, reading the instrument but once, and then only to half minutes, and the tape to hundredths of a foot, an average of these three was taken, and the closing courses computed from that. No correction was made for temperature nor catenary or the temperature was practically the same all the time, about 60° and I endeavored to make the pull about the same on all occasions. Both levels are very wet and there was a strong downcast of air through the winze. All three surveys checked fairly close, enough so to satisfy me that more particular methods were unnecessary, and the result seemed to justify me in this view.

Crystal Falls, Mich.

Two Advertisements of Interest to You.

All the advertising announcements in this journal deserve the attention of the reader, but there are two in the present number—those on pages VI and XI, which give some idea of what MINING AND METALLURGY will be during 1901, and it is hoped these announcements will prove readable to all connected with or interested in any department of the mining, metallurgical or allied industries who may see this issue.

Quartz Mining in Central Siberia.

A party of Americans interested in gold mining has just returned home from a visit to Sarela in Central Siberia. The members of the party were W. S. McCormick of Salt Lake City, N. C. Egbert of Springfield, Mass.; C. C. Ivanitsky, a Siberian mine operator, and C. W. Purington, a well-known American mining engineer. Thomas Smith, United States Consul at Moscow, has recently submitted to the State Department a report embodying much hitherto unpublished information about the section visited by the Americans, which is made additionally interesting by the announcement that as a result of the visit of the Americans the development of the district is likely soon to be begun by American capitalists.

The quartz-mining district lies about 100 miles to the south of the line of the Trans-Siberian Railway and in the mountains lying about the head waters of the River Sarela, which flows into the Nyus, and this again into the Chulim, about 200 miles west of the Yenisei River. The party proceeded north from the town of Chibakee, the residence of Mr. Ivanitsky, and turning off to the west of the main post road from Chibakee to the railroad, crossed the main Chorny Nyus river and followed up the valley of the Sarela. Along the lower course of the stream the valley is more than a mile in width, perfectly flat, and nothing more or less than an immense gravel bed. Low cliffs of limestone border the valley, the walls gradually approaching each other until near the head of the stream, where an immense amphitheatre has been formed, fully six miles in diameter, with mountains walls rising to 2,000 feet above the meeting points of the five creeks forming the main stream. The main valley and its slopes are heavily timbered with birch, cedar, larch and fir, but the dome-like summits of the mountains are bare of all vegetation, except thick reindeer moss and bunch grass. The limestone, which has a great development farther east, here gives place to graphitic schists and dikes and masses of fine-grained porphyry. The creeks forming the head waters of the Sarela give great abundance of water, and so steep is the grade of the valleys in

this upper portion (about ten per cent) that waterfalls and cascades are everywhere seen.

It is only within a year that search of gold-bearing quartz veins has been made in the vicinity of the Sarela. The first discovery of auriferous quartz was, as usual in such cases, the result of an accident, and took place directly in the trail leading to the high Altai region to the west. Search revealed more fragments of white quartz in the vicinity, all showing free gold, and finally a strong lead was uncovered. This was prospected along its outcrop, the strike being in a north-westerly direction for more than 1,000 feet. At the time of the visit of the Americans, the vein was sufficiently uncovered to show an average width of ten feet, and free gold was seen in the quartz wherever pieces were broken off. A sufficiently long extent of this vein has been explored to warrant the statement that the unusual abundance of visible gold does not occur merely in a narrow shoot, as is so often the case, but that here is a shoot with a length of at least 1,000 feet, if, indeed, it be a shoot at all.

This extraordinary vein led to others being looked for, and the result was that in at least twenty different places about the sides of the great amphitheatre, quartz showing free gold was found. In many cases this quartz has been found by merely turning over a few square feet of reindeer moss with a shovel or a pick. Farther to the northeast of the vein just described a still wider vein was uncovered and is being worked by Mr. Podvinself of Ekaterinenburg. This vein is now exposed down the side of the mountain by an open cut 200 feet long and by about 100 feet of tunneling. The exposures show a solid mass of quartz twenty feet wide from wall to wall, with very little horse matter. The work has been done in a very unskillful manner, and the great mass of quartz between the schist walls on the side of the mountain presents a most extraordinary appearance. About 500 tons of this material have been worked in a crude mill, and although free gold is seldom seen, the material has averaged \$18 to the ton with the poorest kind of treatment. A new and better mill is in process of erection, but it is placed in a poor position and is of such small capacity that very little can be expected from it.

The majority of the quartz finds in this valley have been made in high places, the situation of the lead outcrops being such as to facilitate the tramping of the ore down from the workings to a mill located at the meeting point of the five streams, by means of converging wire-rope gravity lines. The topography is also favorable for the running of cross-cut tunnels at comparatively low levels, and thus getting under large quantities of ore. Water power being practically unlimited in quantity, timber of excellent quality available, and winter freight rates exceedingly low (\$5.50 per ton from the railroad), the district of Sarela appears to have many advantages as a mining country. The Americans, although familiar with the gold fields of Alaska, California and the Rockies, were favorably impressed with the showing which the exceedingly small amount of prospecting had developed.

It is very unusual for free gold to play so large a part in undeveloped quartz outcrops as is here found. In one or two outcrops along the course of a strong lead there may be a showing of free gold, but for free gold to be found for hundreds of feet along the course of a vein wherever samples were broken off is sufficient to cause the old prospector to open his eyes. The quartz appears very lively in all the veins yet uncovered and exhibits the marks of decomposed sulphurates. It is therefore highly probable that the great majority of the free gold exists below the water level in the form combined with iron sulphide. It will, of course, after water level is reached, necessitate treatment of chloridation or potassium cyanide.

Water level in this particular locality must, however, lie at considerable depth, so that the tenor of these veins may be thoroughly established by the use of small mills, of free-milling capacity only, before the refractory portions of the veins are encountered. The walls are well defined, and the principal veins all strike in the same direction, showing that it is a country of continual and regular lenses, and not of broken or irregular stringers. As the veins are for the most part nearly vertical and are subject to no sudden distortions of the structure, mining here should be a comparatively easy operation, and it is not likely that excessive amounts of timber would be required.

It is a well-known fact that the climate in southern Siberia is perfectly healthy, and in some respects most enjoyable. It is true that for five months in the year extreme cold is experienced throughout the country, Fahrenheit temperature dropping as low as 30° and 40° below zero; but the fall of snow is very light, and the progress of quartz operating is no more impeded by winter conditions than in the mountain districts of Colorado and Utah. Naturally, all the machinery must be well housed and the mill heated in winter, but this is a small matter in a country with an inexhaustible supply of wood, and where the cutting of it costs next to nothing. It caused amazement to the Americans that in Inner Siberia, where they had imagined life unendurable in the winter months, this very time should be considered by the inhabitants the finest of the year. According to descriptions, the climate must correspond with that of portions of Canada and the Rocky Mountains.

The labor in this district also occasioned surprise. Here were men whose total cost to the operator, including food and transportation to and from the mine, was less than \$15 per month, yet who were both intelligent and capable; hardy enough to work out the year round in this climate, to sleep if necessary on the hard ground without tents, and to live on dried black bread and soup meat. Mr. Purlington, fresh from the South American gold mining fields, where indolent negroes must be paid \$1 a day for their poor work, expressed himself as highly gratified to find such good and economical labor in Siberia.

It is quite certain that the discovery of quartz veins in Siberia has but just begun. The well-known lack of ambition of the Siberian to improve his own condition, except by the means employed by his father before him, and his disinclination to extend his sphere of knowledge must be taken as the principal cause of the lack of quartz operations up to this time.

Amalgamated Copper Statement.

The report of the Amalgamated Copper Co. to the New York Stock Exchange says that the company has no bonded debt and five quarterly consecutive dividends have been paid. The company owns the entire stock (organizers' shares excepted) of the Washoe Copper Co., Butte, \$5,000,000; Colorado Smelting & Mining Co., Butte, \$2,500,000; Diamond Coal & Coke Co., Wyoming, \$1,500,000; Big Black Foot Milling Co., Montana, \$700,000. It owns a majority of the Anaconda Copper Mining Co., \$30,000,000; Parrott Silver & Copper Co., \$2,298,500, and the Hennessy Mercantile Co., \$1,500,000. The company is a large owner of the stock of the Boston & Montana Consolidated Copper & Silver Mining Co. There is no bonded debt on any of the above named companies. An extract of the certificate of incorporation permits the company to purchase, subscribe for, or otherwise acquire and hold the stock or obligations of any company in the United States, its colonies or any foreign country. The by-laws provide that the company be managed by eight

directors. The annual meeting is on the first Monday of June each year. The directors may appoint an executive committee of three of their number with the president ex-officio, which shall have all the power of directors when the board is not in session. The directors may at their absolute discretion set aside such sums as they think best out of the net profits for contingencies, equalizing dividends, repairs or maintenance. Dividends shall be declared on the third Thursday or next business day thereafter of September, December, March and June and be paid on the last Monday or next business day thereafter of October, January, April and July.

Mining Definitions.

It is always well and often of vital importance to use mining terms in their precise technical significance. The following definitions of some common terms, prepared by Alfred Harper Curtis, M.E., will interest our readers:

(1.) The "strike" of a stratum or bed is "the angle formed with the meridian by the direction of a horizontal line drawn in the middle plane."

Assuming that the surface be a level plane, the line of outcrop of a bed coincides with its strike.

(2.) The "dip" of a bed or vein is the downward inclination measured in degrees from the horizontal.

The dip and underlie of a vein are the same only when the measurement of each is 45°.

In the United States, the determination of the amount of dip, in the case of a metalliferous vein, is of importance chiefly from engineering and economic standpoints, for such deposits may be followed by a company along their dip "throughout the entire depth," even if they "so far depart from the perpendicular . . . as to extend outside of the vertical side lines of the claim," the extent of the miner's liberty to exploit the vein being limited only by the vertical planes through the end lines. In Africa, Australasia, and other countries, the mining right on any vein is limited by the vertical planes through both the side and end lines, which renders the correct estimation of average dip a most important matter.)

(3.) "Shoot," "shoot of ore," "pay-shoot," or "chute."—A more or less well-defined zone containing the richer and payable portion in a vein of metalliferous mineral, as distinguished from poorer portions of the vein, the whole or the bulk of which it may be impossible to exploit profitably or at a satisfactory profit.

"Patches," "pockets" or "bunches" of payable ore, which have ultimately been proved to have little persistence in depth, have frequently been mistaken for and described as pay-shoots by experts examining a property during the early stages of its development. It must, however, be remarked that many zones to which the term shoot is strictly applicable contain the profitable portions of their ore concentrated in irregular rich bunches.

(4.) "Ore-in-sight" or "ore-reserves."—These much ill-used terms technically include, in their least restricted sense, only such ore as is contained in blocks at least two faces of which have been exposed by connected drifts and shafts or winzes. In its very strictest sense, the term ore-in-sight is used to signify the net tonnage of workable ore contained in rectangular blocks of reasonably limited size exposed on at least three faces, that amount of exposing being absolutely necessary for the accurate calculation of average width, when the vein is very variable in this dimension. Deduction should be made not only for ore already extracted from these blocks, but also for ore that cannot be profitably mined. The well-defined outcrop of a vein may be regarded as an exposed face.

Cripple Creek and Kalgoorlie Tellurides.

Tellurides an Important Source of Gold—Differences Between the Colorado and the West Australia Deposits—Sylvanite, Petzite, Roscoelite and Other Companion Ores.

By T. A. Rickard, Denver, Colo.

The lodes of Cripple Creek, Colo., partake of the composition of the geological formation which they traverse. The prevailing rocks are andesitic breccia, lying upon granite, and also bodies of phonolite, trachyte phonolite, nepheline-basalt, etc., penetrating both the granite and the breccia. At Kalgoorlie, in West Australia, the prevailing rock is schistose, and has not been certainly identified, though microscopic sections indicate the probability that it was originally an acid eruptive. The lodes are essentially bands, more highly schistose than the encasing rock, and impregnated to a notable degree with disseminated pyrites and secondary calcite.

During 1899 Cripple Creek produced 425,590 tons of ore, having a gross value of \$16,658,264; during the same period the output of Kalgoorlie was 467,048 tons, valued at \$17,724,587.

Telluride ores have become an important source of gold during the past five years on account of the discoveries made in Colorado and West Australia. They have been treated as something quite new and phenomenal. As the result of the success of the two districts there grew up a notion that this mode of gold occurrence indicates ore bodies of specially persistent nature—a fallacy akin to the older one which assumes an enrichment with depth as a general characteristic of gold veins. Tellurides have been mined in Transylvania for a century, and they have been known in Colorado, as important ores of gold and silver, since 1872—two districts, the La Plata mountains and Boulder county, yielding them in commercial quantities. In none of these regions have they been characterized by special continuity in depth. On the contrary, until Cripple Creek, and then Kalgoorlie, commenced to make a record, it was generally held, among those who were aware of the facts, that telluride ores were erratic in behavior and difficult to treat. The former proposition is not more true of them now than of gold deposits in general; while the latter has been largely modified by the advance of metallurgical practice.

As is well known, the tellurides, or combinations of tellurium with the metals, are similar to the combinations formed with sulphur and selenium. The first determination of this interesting group of minerals is due to Klaproth, who, in 1802, recognized them in the ores of Zalathna, in Transylvania. Tellurium is a non-metallic element. In its chemical combinations it acts in a manner analogous to sulphur, which it appears at times to replace. Native tellurium is a tin-white, brittle substance with a bright metallic luster. Its commercial value is \$3.50 per ounce; but the demand for it in the arts is very slight, and a few shipments demoralize the market, as is the case with most of the rare earths. It is extremely uncommon both at Cripple Creek and at Kalgoorlie, but in Boulder county, Colo., it is frequently encountered. A mass weighing twenty-five pounds was found in 1877 at the John Jay mine, near Jimtown. In Gunnison county, in Southern Colorado, it has lately been found at the Vulcan mine, in mica schist, associated with a lode of gold-bearing pyrite, which, in the oxidized zone, includes masses of native sulphur.

KALGOORIE'S TELLURIDES.

Kalgoorlie affords the finest specimens of the telluride of gold, calaverite, in generous splashes of lustrous yellow, which glorifies the dull-looking schistose rock. Analyses yield nearly forty-

two per cent of gold, with less than one per cent of silver. The specific gravity is given as 9.277. At Cripple Creek gold specimens of calaverite are rare, but it occurs finely disseminated through the ores, although somewhat obscured by the presence of sylvanite. Analyses indicate the average composition as ranging from thirty-eight to forty per cent in gold, with about three per cent of silver. The specific gravity is given as nine. The Cripple Creek variety therefore makes a very close approach to Genth's original determination of the specimens from the Stanislaus mine, in Calaveras county, Cal., the locality from which the mineral derived its name.

In Boulder county, Colo., which yielded some of the earliest specimens, a splendid mass of calaverite was found in 1877 at the Meivina mine by Henry Neirkrirk, a Dutchman, who, while prospecting, drove his pick into a mass of soft, clay-like, unctuous material, and on withdrawing it found that it was gilded. The mass consisted of lemon-colored oxide of tellurium containing fine particles of amorphous gold, the two substances being the product of alteration from the bronze calaverite which Neirkrirk found deeper down, associated with magnesite and fluorite. This dioxide of tellurium, or tellurium-ocher, has been found in Transylvania. It is very rare because of its marked affinity for ferric salts, with which it forms a definite compound, the tellurite of iron.

The tellurite of iron, which Knight was the first to determine, has a light-brown color and a bright yellow streak. It occurs also in a specimen which I obtained at Kalgoorlie. As a mineral it has only an academic interest, but the chemical reactions of which it is the result play an important part in the treatment of telluride ores. Namely, in roasting these ores the tellurium is not driven off with the sulphur, but, as soon as it has volatilized, it becomes oxidized to TeO_3 , and is fixed in the roasted charge by combining with the oxide of iron due to the calcination of the pyrites in the ore. What tellurium does escape, and is subsequently found in the flue-dust, is carried away mechanically by the draft. This is the experience of our reduction works. Richard Pearce has made laboratory-tests to elucidate the matter, and has found that as much as 96.4 per cent of the tellurium has remained in the ore after it had been roasted.

In nature a kindred action probably occurs, the decomposition of the gold-bearing telluride in the presence of oxidizing pyrite liberating the gold with the formation of the tellurite of iron. The gold, thus set free in a metallic condition, has characteristics which readily distinguish the surface ores of all telluride lodes. At Mt. Morgan, it was found, in 1880, that the dull-looking gold would not amalgamate in the stamp mill. Dr. Leibius, of the mint at Sydney, decided as the result of experiments that the gold, which was of remarkable purity, was probably coated with an oxide of iron. In 1893, I remarked the similarity between the gold of the famous mine in Queenland and the specimens given to me at the Pike's Peak and Garfield Grouse mines, on Bull hill, Cripple Creek, but it was not until 1897 that the resemblance was traced to a common cause, the derivation of the gold from tellurides. The soft, brown gold resulting from the alteration of tellurides has the appearance of gold precipitated from solution. Its pasty, spongy, but slightly compact character has caused it to be named "mustard gold" at Kalgoorlie. It occurs in splashes like yellowish clay, and can be detected by scratching, which burnishes it, so as to exhibit the unmistakable glint of the precious metal. At Cripple Creek very perfect pseudomorphs after sylvanite and krennerite are obtainable. In the Gold King vein patches of these can be seen in a series of quartz geodes, the gold looking, as the

miners express it, "like splinters of rotten wood." Free gold at Cripple Creek has invariably that appearance which characterizes the metal when it has originated from the disintegration of tellurides; but at Kalgoorlie, ordinary gold, in a bright and crystalline condition, also occurs. It is usually in coarse particles, the size of which hinders complete extraction by leaching and becomes a factor in the ore treatment. At most of the cyanide mills there are supplementary amalgamating tables, over which the tailings are conducted after they have been discharged from the vats, so as to extract any of these larger particles which may have escaped solution. They would escape, not only by reason of their larger dimensions, but because they would lack that spongy character conducive to quick leaching, possessed by gold which has resulted either from the alteration of tellurides in nature or from their decomposition in the roasting furnace.

THE SYLVANITE OF CRIPPLE CREEK

Sylvanite, although it does not carry the largest portion of the gold obtained from the Cripple Creek ores, is the telluride most frequently seen in the specimens from that district. It is uncommon at Kalgoorlie, but is particularly characteristic of the ores of Boulder county, especially in the mines around Salina. The name of this beautiful mineral originates from the historic mining region, Transylvania, where the compounds of tellurium were first detected. Its brilliant silver-white twinned crystals are often distributed over the faces of pieces of rock so as to look like Arabic writing. Hence the alternative name of "graphic tellurium." One of the first analyses of a Cripple Creek specimen was made in 1894, by Richard Pearce, who found that the composition agreed closely with that obtained by Genth, in 1874, from the sylvanite of the Red Cloud mine, in Boulder. August Frenzel gives the analysis of a specimen from Kalgoorlie which he labels sylvanite; but the composition is much nearer that of krennerite, the prismatic, brilliant, vertically striated crystals of which occur in the ores of the Moon Anchor and other mines on Gold Hill, Cripple Creek. The color of krennerite is like that of sylvanite, but it has a greater tendency to a slight brassy-yellow tinge. It is the most beautiful of all the tellurides.

While visiting the Kalgoorlie mine, at Kalgoorlie, in 1897, I received a specimen of so-called "black tellurium," which was said to be the native metal itself. Under a simple test in a tube over a blow-pipe it volatilized completely, but left a deposit of quicksilver globules at the cold end of the tube. It was coloradoite, the telluride of mercury, which was first detected by the industrious Genth in specimens from the Mountain Lion mine at Magnolia, Colo. It is iron-black, with a sub-conchoidal fracture and the rich unctuous luster which characterizes several other tellurides, notably calaverite. At Kalgoorlie native mercury and native amalgam have also been found. In addition to these previously known minerals there is a variety of coloradoite which has been named, by Mr. E. F. Pittman, kalgoorlite. As the crystallographic features do not differ materially from coloradoite, it can hardly be considered as more than an impure variety of the latter, and may be looked upon as a mixture of petzite and coloradoite.

At the Associated Mines, Kalgoorlie, there occurred a mineral which resembled this supposed kalgoorlite. The analyses of W. F. Grace proved that it was petzite.

Petzite is not common, either at Kalgoorlie or at Cripple Creek. In the former district it occurs both in the Associated mines, as stated, and also in the Great Boulder Main Reef; and therefore, presumably, in other mines. At Cripple Creek I have seen it in specimens from the

Genera on Gold Hill, and in the ore of the Porter Gold King. Above Anaconda, Patsite is the characteristic mineral of the Golden Fleece mine, an isolated occurrence of tellurides, in Lake county, Colo., which, between 1894 and 1896, produced \$1,100,000 from a comparatively small tonnage of ore. It is very probable that future investigations will lead to the recognition of several new varieties of tellurides in both of the two districts under discussion, but it will be necessary for this purpose to obtain crystalline specimens, so that analyses of composition may be supplemented by the measurement of crystal angles.

TWO COMPANIONS OF TELLURIDE

Of the minerals which seem to be specially associated with tellurides two are particularly notable fluorite and roscoelite. Fluor spar, or fluorite, the fluoride of calcium, is a frequent companion of lead ores, not so much in the United States as in England and Saxony. In Colorado it characterizes the telluride ores of both Boulder county and Cripple Creek, especially the latter. Hence it was at one time supposed to be a favorable indication of richness in the lode, but later experience has exploded this generalization, together with several others. The prevailing color of the fluorite at Cripple Creek is from amethyst to purple. Large crystals are rare. Much of the coloring which serves as a beautiful background for the lustrous tellurides is but a stain upon the silicified breccia and other lode matter. The presence of fluorite in the granite outside the gold mining area checks the inferences which might otherwise be made from the fact of its prevalence in the veins.

Fluorite does not characterize the lodes at Kalgoorlie, but calcite may be said to be a feature of their mineralization, particularly in view of the fact that the ordinary free gold veins of the neighboring districts, such as Coolgardie, do not carry it in notable amount. Calcite is rare at Cripple Creek. It is occasionally encountered, lining cavities in the eruptives. The small percentage of lime in the ores, as reported by the smelters comes from the fluorite. Calcite is frequent in the telluride lodes of Boulder.

Roscoelite has a peculiar interest for the student of telluride ores. It is a brownish-green micaceous mineral, belonging to the hydro-mica group, and remarkable as carrying a large percentage of vanadium. This uncommon mineral was found in handfuls, in the form of small dark greenish-brown micaceous spangles, by the miners who worked the placer ground in the ravine below Sutter's mill, Cal., where gold was first discovered in California. It accompanies the tellurides of Boulder to such an extent that the miners have got into the way of considering it a gold-bearing mineral in itself, instead of a mere accessory. The Boulder variety is grayish-green to olive-green. It frequently stains the quartz and other vein stuff, so as to give them a strong green color, resembling that of ordinary chlorite. In 1897 several specimens of the ore from the Great Boulder Main Reef mine at Kalgoorlie were sent to me, and I thought that roscoelite was discernible. Mr. Pearce subsequently made an investigation which confirmed this opinion.

Roscoelite has not yet been recognized at Cripple Creek, but chlorite occurs freely, especially in the Elton and Mary McKinney lodes. Various forms of chlorite are also in part responsible for the prevailing green coloration of the protogine of Boulder and the schistose bands of Kalgoorlie. Analytical tests might succeed in separating a particular variety as a characteristic of these ores. It is, to say the least, very suggestive that the telluride veins in the granite of Cripple Creek, the schist of Kalgoorlie and the protogine of Boulder, should all be characterized by the presence of chlorite. Of course, it may be regarded simply

as the product of the decomposition of the biotite and augite in the prevailing country. Nevertheless, it remains an interesting coincidence.

The small amount of quartz occurring in these telluride veins is a feature worthy of notice. Quarz is so common a matrix for the precious metal that it has been called by some the "mother of gold." At Kalgoorlie a notable amount of quartz is considered an indication of poverty; at Cripple Creek there is more quartz, but it never predominates to the extent which marks the ordinary gold veins of California and Victoria. Much of the secondary quartz, as distinguished from the siliceous ground-mass of the country itself, is hydrous and opalescent. This enlivens the cracks and cavities resulting from the most recent lines of disturbance. In Boulder county the quartz takes the form of a dark flinty substance, the "hornstone" often referred to in description of the lodes.

Chill's Copper Production.

A comprehensive summary of the condition of copper mining in Chill, based on recent consular reports, is presented on the editorial page of a recent issue of the Mining Journal of London. It is well known that Chill's reputation as a copper producer has suffered somewhat in recent years for various reasons. During the last year, however, according to the Mining Journal's sources of information, there has been a notable revival.

Mining for copper has received a great impetus from the high price of the metal, with the result that production has lately been considerably on the increase. According to a consular report for 1899, issued a week or two back, the total exports of copper from the Republic to foreign countries were 15,553,087 kilos. In excess of the quantity exported in 1898, the total being 35,854,439 kilos, or 35,290 tons. On the other hand, copper bars show a decreased export of 3,288,978 kilos, or 3,200 tons, as compared with previous years, the total shipments being 17,038 tons, but owing to the advanced price of the metal, the value was £75,000 greater than in 1888. Copper ingots in the rough show a decrease of 1,368,108 kilos, the total export being 1,710,460 kilos. But these figures give no adequate idea of the great revival that has taken place all over the Republic. A large number of mines have been restarted, new companies have been formed, and what is equally as important, more scientific and economical methods of working are being introduced, while efforts are being made to provide cheaper transport. It is also worthy of note that the local foundries of British firms are turning out mining machinery of a very high class, and important experiments are being made with electric drills, which, it is hoped, will enable copper to be worked which has hitherto been unworkable. Thus it is evident that this revival bids fair to last some time, even though the price may drop considerably, for with economical working and better machinery the costs can be so reduced as to enable profits to be earned where, in the past, losses compelled the mines to be shut down. A number of copper mines have been opened in the district of Arica, but until the existing railway from Arica to Tucna is extended inland towards the Bolivian frontier the expense and scarcity of transit will seriously hamper the output of these mines. An English Vice-Consul reports from Tocopilla that copper mining is undoubtedly on the increase in that neighborhood, although the amount of copper shown as having been shipped during the past year does not bear out his statement. This is, however, probably due to the fact that some of the metal produced in 1897 was not actually shipped until early in the following year, thus unduly swelling the output of 1898. On the other hand, there was

considerable difficulty in the production of copper at Taltal, and great activity still prevails throughout this district. The mines have been worked out, and the old mines have been reworked. There are, however, important copper properties in the neighborhood worked merely in a degree sufficient to preserve legal titles, which, if obtainable for a moderate price, would, under systematic mining, and efficient management, yield remunerative returns. The mineral exported to Great Britain averaged twenty-four per cent copper contents, and the quantities forwarded to the reduction works in the south of Chill assayed fifteen per cent on an average. In one or two other districts, however, there has been no improvement in the production over 1898, while in the district of Carrizal Bajo there was a falling off. The cause of this decline was an influx of water into the principal mine, with which the machinery was unable to cope, thus delaying the work for a long time. At Caldera the output has been just a little more than last year, owing, principally, to the lack of sulphates, there being a large surplus of carbonates, for which there is very little demand either on the coast or in Europe. This state of things is enforcing the mine owners either to invest capital in sinking to the necessary depth, or to close down. Some good sales of properties have been effected, the most important being the purchase of the Lautaro mine at Amolonas by the bank of Edwards & Co.; the Carmen Alto and San Francisco groups at Ojancos by the Copiapo Mining Co., and the Transi mines in the same district by a Santiago syndicate. From this district 1,972 tons of copper bars were exported. This shows a steady increase in the output, the production for 1898 being 1,734 tons, and for 1897 1,327 tons. Of copper ores 20,067 tons were shipped, and of copper rough bars 282 tons were sent away. The prospects for the whole of the Republic are undoubtedly very bright, and Chill is as likely as not once again to occupy an important position as a contributor of copper to the world's stocks.

The Reported Smelting Combination.

An official of the American Smelting & Refining Co. authorizes the following statement:

"There have been some negotiations in regard to purchasing the Guggenheim property, but there has never been any price agreed upon, and there has been no price talked of since last April. The directors will hold the next meeting in December and the matter may come up for consideration at that time. In regard to considering dividends on the common stock, there is no probability of the question being discussed at the next meeting of the board, and it is safe to say that this matter will not be considered under any circumstances until after the close of the fiscal year next May. Our company uses a great deal of money in its business, and until we are entirely free from debt and have an ample amount for working capital, dividends will not be commenced on the common stock. In order to take the best advantage of the markets and to conduct the business without borrowing money it requires a large working capital. Our business is showing satisfactory profits and earnings are fully up to expectations."

Atlin's Biggest Nugget.

J. D. Harrington of Seattle, Wash., is the owner of the largest specimen of pure gold ever taken from the Atlin district. The specimen is of nugget formation and weighs twenty-nine ounces, seventeen pennyweight and twelve grains, and is valued at \$502, although Mr. Harrington has refused offers of \$7,000 for it. The nugget was picked up in Harrigan's bench claim No. 9 on Pine Creek at a depth of about ten feet.

The Low-Grade Problem in Arizona.

Mohave County miners will have to do some floating on low-grade ore basis. The big veins of low-grade sulphide ores will have to be handled and some day will be the groundwork of the county's prosperity. All over the county there are great veins of low-grade ores, carrying values in gold, silver, lead and copper, that can be handled in various ways. Much of the copper can be concentrated and mated with the addition of iron sulphide ores. In Layne Springs and Todd Basin are many veins of ore suitable for concentration and mating purposes, and before a year passes by we expect to see machinery for its reduction put in. The success of a plan of this kind in that section would work wonders throughout the county and possibly add greatly to the mining successes of Arizona.—Mohave County Miner.

Latest Mining Decisions.

Specially Prepared for THE MINING AND METALLURGICAL JOURNAL.

In an action to enjoin trespass on a mining claim, proof that the defendants are insolvent is not of itself sufficient to justify granting an injunction. Parker vs. Furlong et al., 62 Pac. Rep. (Or.) 190.

Where defendant purchased a mining claim, and shortly thereafter abandoned it because unable to do the assessment work, it was error to refuse to charge that defendant intended to abandon his rights under his purchase. Niles vs. Kennan, 62 Pac. Rep. (Colo.) 360.

Code Civ. Proc. § 1732, authorizing a stay of execution pending an appeal from a judgment directing the delivery of possession of real estate, applies in case of an appeal by defendant in ejectment involving an unpatented mining claim. State ex rel. Baker vs. Second Judicial Dist. Court of Silverbow County et al., 61 Pac. Rep. (Mont.) 882.

Where defendant purchased a mining claim on December 26, 1890, and thereafter abandoned it because unable to do the assessment work, and defendant's son relocated the claim as an abandoned claim on January 30, 1891, the relocation was invalid, and did not prevent a location by others. Niles vs. Kennan, 62 Pac. Rep. (Colo.) 360.

Where plaintiff sued for damages and to enjoin defendants from flooding the debris down on plaintiff's mining claim in the operation of defendant's mine, which was situated just above plaintiff's, on the same creek, an answer which alleged that plaintiff leased his mine to defendant in consideration of which they dug ditches, constructed flumes, and put in sufficient pipes to operate it, was properly struck out, on motion, as irrelevant. Miser vs. O'Shea et al., 62 Pac. Rep. (Or.) 491.

A coal miner who, during the noon hour, while not engaged in work, goes to a different part of the mine, for the purpose of visiting with another miner, is not, while so absent, engaged in the line of his duty, so as to impose upon the employer the duty of a master to see that the entry through which he passes from and to the part of the mine where he is employed is kept in a safe condition for his passage. Ellsworth vs. Metheny, 104 Fed. Rep. (U. S.) 119.

Where, in an action to enjoin defendants from trespassing on a mining claim and destroying plaintiff's gates, ditches, etc., the only evidence of trespass was on one occasion when one of defendants came and commenced digging on a ditch, and refused to go when ordered, saying that he was going to pull up the plaintiff's gates and take the water they were using, the complaint was properly dismissed, since an injunction to restrain trespass on a mining claim will not issue on proof of a single act of trespass. Parker vs. Furlong et al., 62 Pac. Rep. (Or.) 490.

Defendant purchased a mining claim December 26, 1890, and shortly thereafter abandoned it because unable to do the assessment work. Defendant re-entered the claim January 30, 1891, as an abandoned claim, giving the date of discovery as December 29, 1890, and then conveyed to defendant, who claimed solely under the relocation until after plaintiff had located an interfering ledge. Held that defendant could not recall his abandonment, and claim that the relocation was to protect

his rights under the original claim. Niles vs. Kennan, 62 Pac. Rep. (Colo.) 360.

Where, in an action for damages occasioned by defendants flooding plaintiff's placer mine with debris from defendants' mine, which was situated just above plaintiff's, on the same creek, defendants defended their right on the ground of adverse user before plaintiff obtained title to his claim from the United States, but did not show that such adverse user existed for 10 years subsequent to the acquisition of plaintiff's title, such use constituted no defense to the action, since there can be no adverse user as against the United States. Miser vs. O'Shea et al., 62 Pac. Rep. (Or.) 491.

Plaintiff brought an action for damages, and to enjoin defendants, who own a placer mine just above plaintiff's, on the same creek, from flooding debris down on plaintiff's claim in the operation of defendants' mine. Defendants filed a counterclaim for damages occasioned by water being backed up on their claim in consequence of a dam built across the creek below defendants' mine by plaintiff. Held, that the counter claim was properly struck out on motion of plaintiff, since such damages were in no way connected with the subject of the suit, and also arose from an independent trespass. Miser vs. O'Shea et al., 62 Pac. Rep. (Or.) 491.

In an action for damages occasioned by defendant's flooding debris down on plaintiff's placer mine from defendant's mine, which was situated just above plaintiff's mine, on the same creek, defendant claimed to do so by virtue of a license from plaintiff, and alleged that on the strength of such license he had made valuable improvements on his own claim, but did not show that he paid anything for the license, or that he had not been repaid for his improvements by the operation of his own mine. Held, that the license was revocable, and did not constitute a defense to the action. Miser vs. O'Shea et al., 62 Pac. Rep. (Or.) 491.

Where the miners in a coal mine, with the knowledge and implied consent of the owner, are accustomed to use the passages or entries in the mine as a place for congregating or passing to and fro during the hours of recreation, it is negligence in the owner to introduce and extend along such an entry an electric wire which is dangerous to the life of those who come in contact therewith, without properly insulating or enclosing the same, or giving notice of the danger to those who, he should reasonably apprehend, are likely to be brought in contact with it, and such negligence will render him liable for the death of a miner who, in the accustomed use of the premises, and without knowledge of the danger or negligence on his own part, is killed by coming in contact with such wire. Ellsworth vs. Metheny, 104 Fed. Rep. (U. S.) 119.

TRADE NEWS.

The Sullivan Machinery Co. of Chicago reports the sale of eight coal cutting machines to the Northern Coal Co., three to the Victor Fuel Co. and three to the Colorado Fuel and Iron Co.

In the first half of November, the Chicago office of the Babcock & Wilcox Co. did a business equal to that of the entire month of October. The October record was the best for any month of the present year.

The Triumph Electric Co. of Cincinnati, O., has shipped a large generator, with an expensive switchboard, to the Marmet Coal Co., at Marmet, Va. The generator will be used in the operation of coal mines.

The Link-Belt Engineering Co. of Nicetown, Pa., has opened an office in Pittsburg, Pa., for the transaction of business in that vicinity. T. Frank Webster is in charge, with offices at 1501-1502 Park Building.

The Lane & Bodley Co. of Cincinnati has recently sent out three compressors to be used in the famous Robinson diamond mines at Johannesburg, South Africa. A fourth compressor will soon be shipped.

An illustrated catalogue showing more than seventy kinds of well-digging machines has been issued by Williams Bros. of Ithaca, N. Y. The machines described can be operated either by horse-power or by steam.

In the month of October the Denver Engineering Works shipped seventeen carloads of machinery and mining supplies. In the first five days of November, six carloads were sent out. This record

does not include local shipments of less than five carloads.

The Colorado Iron Works of Denver is constructing a number of double-deck safety mine cages for the Portland mine at Cripple Creek. They have recently shipped two large smelting furnaces to the Rocky Mountain Smelting Co. at Florence, Colo.

The Joshua Hendy Machine Works of San Francisco, Cal., has secured a large order from the Bald Mountain and Mammoth mines. Included in the consignment will be a rock breaker, four ore feeders and four five-stamp batteries. The order was taken by J. K. Flirth.

August Mietz of 124 Liberty St., New York City, has just issued a catalogue describing the Mietz & Weiss engine for gas and kerosene which received a silver medal at the Paris Exposition. The catalogue shows the engine in operation under varying conditions and describes its construction in detail.

Moses Wade & Wade, the well-known Los Angeles smelters and metallurgists, have announced that another edition of their work on Gold Metallurgy is to be published soon. The first edition became exhausted a short time ago, and the demands for the book have been so numerous and insistent that it will be issued in a second and better edition.

E. O. Denniston, proprietor of Denniston's San Francisco Plating Works, announces the removal of his office from 652 Mission St., San Francisco, to 712 Mission St., between Third and Fourth Sts. Mr. Denniston says that he now has the largest and most complete plating works on the Pacific Coast. His works have been in successful operation for thirty-five years.

It is announced that the Edward P. Allis Co. of Milwaukee, Wis., is about to extend its plant by the erection of large new shops outside the city. The buildings will be put up on a site of eighty or one hundred acres, and will cost about \$2,000,000, exclusive of equipment. Leading citizens of Waukesha are endeavoring to have the plant located in their town.

The General Electric Co. has secured a contract to furnish the generating plant and transmission lines for a company in India which proposes to convey several thousand horse-power from the Cannan Falls to the Mysore gold fields, a distance of ninety miles. The General Electric Co. will receive \$700,000 for its share of the work, which is to be completed in February, 1902. About 410 tons of copper will be required.

The Homestake Mining Co. of Lead, S. D., has placed an order with the Gates Iron Works of Chicago for 10,000 special stamp shoes. The order is unique in the fact that it is probably the largest order for stamp shoes ever placed by one company. The Gates Iron Works have been supplying the Homestake Company with its shoes for several years. The trade was established under severe competition on the point of quality. Fifty-one freight cars will be required to carry the present order.

Roy Hopping, the New York mineralogist, has just issued his fall catalogue. Special attention is devoted in the catalogue to Mr. Hopping's collection of aragonite, pisolite, and orthoclase crystals from Karlsbad, hyalite opal from Bohemia, kidney ore hematite; also calcite and satin spar from England, quartz geodes from Iowa, sandstone from Canada and zinc minerals from New Jersey. Mr. Hopping states that his prices for foreign minerals are lower than those asked by German dealers.

W. H. Finnie of Denver, Co., operates the following mining and smelting machinery: A cross-compound air compressor, 100 H.P. 1000 ft. high, with two 60-H.P. 1000 ft. high air compressors together with drill columns, etc., complete, to the Minnie Gulch M. & T. Co. at Silverton, Col.; a light dynamo (Bell Electric Co.) with lamps complete, to the Camp Bird mine at Ouray, Colo.; a cross-compound Rand air compressor to the Colorado Southern Railway Co., Denver; a cross 1000 ft. air compressor to A. E. Reynolds, Denver, for use at his mines.

The Weber Gas & Gasoline Engine Co. of Kansas City, Mo., has just received a large order from W. Z. Kinney, superintendent of the Great King Consolidated Mines Co., of Silverton, Colo., testifying to Mr. Kinney's statement that Mr. Weisheit, Mr. Kinney's testifying to the fact that of the long-standing question of the use of gas and gasoline in the smelting of the King's mines, His Honor said, "We have had one of your 25 HP gasoline engines in

constant use at our mine, situated at an altitude of 12,126 feet above sea level, for the past year and a half, and have found it very satisfactory indeed, doing all that you claim for it, and being very much cheaper to operate than a steam plant. We have no hesitation in recommending it to any one requiring an economical hoisting plant."

Among the recent sales reported by the J. H. Montgomery Machinery Co. of Denver, are the following: One one-horse whim and equipment, to H. C. Logan, Fort Garland, Colo.; one 80-HP. tubular boiler, one ten-drill air compressor, one air receiver, one Penherty injector, one pump, pipe and air pipe for boiler and compressor, to J. P. Flitting, Cripple Creek, Colo.; one steam-jacketed kettle to E. B. Blittinger, Leadville, Colo.; one two-horse whim and equipment, two ore cars with 200 feet of track, switches, etc., to E. E. Souther Iron Co., Estacion Bajan, Mexico; blower and air hose to Lake George Mining Co., Lake George, Colo.; one eight by nine air compressor, one 20-HP. vertical boiler with all necessary attachments, one boiler-feed pump, one deep well pump, with pipe, Samuel Andrews & Co., Evans, Colo.; one swing saw frame with arbor, Denver City Tramway Co.; one 80-HP. horizontal tubular boiler, one steam pump, exhaust fan, 5-HP. Shipman engine, to Excelsior Brick Co., Denver, Colo.

PERSONAL.

H. W. Hoyt, secretary of the Gates Iron Works of Chicago, has been honored by being elected president of the National Founders' Association, at the recent meeting of that organization in New York.

Milton E. Coombs, for twenty years superintendent of the American Steel Hoop Co.'s rolling mills at Girard, O., has become general manager of the company's mill at Youngstown.

H. B. Vercoe, manager of the affairs of the Gavitt Grant in Riverside county, Cal., as the representative of the English syndicate owning the property, has renounced allegiance to the Queen of England, and has been admitted to citizenship in the United States.

Joseph H. Williamson, for nearly eighteen years business manager of the Manufacturers' Advertising Bureau of New York City, is now business manager of the Viennot Advertising Agency at 524 Walnut St., Philadelphia. Mr. Williamson will have a branch office in New York City at 127 Duane St.

A. J. Shores of Great Falls, Mont., vice-president and general attorney for the Montana Central road, has been appointed chief counsel for the Amalgamated Copper Co. at a salary of \$20,000 a year. Wm. Scallion, whom he succeeds, will henceforth give his entire attention to the Daly estate. Ransom Cooper of Great Falls is attorney for the Boston & Montana branch of the Amalgamated Co.

Construction and Development News.

New mines at Altoona, Pa., are being opened by W. T. Underwood of that place.

The Concord Gold Mining Co., W. W. Robbins, manager, at Lawton, Ore., will install new machinery and a mill.

E. J. Blain, manager of the Twin Sisters Gold Mining Co. at Centerville, Ida., will superintend the erection of a five-stamp mill.

A gasoline hoist is to be put in at the Napoleon mine in the Stringer district, near Randsburg, Kern county, Cal.

The Holy Terror Mining Co. intends to erect a twenty-stamp mill at Keystone, S. D. S. R. Trengove is superintendent.

Pugh & Menzell at Clear Creek, Shasta county, Cal., intend to erect a hoisting plant and pumping machinery on their property.

J. A. Thompson and C. H. Booth of Taylor, Tex., have organized the Taylor & Sinaloa Mining Co., and will conduct a general mining business.

The Hite Cove Mining Co. contemplates the erection of an electric light plant at its property near Hite Cove, Mariposa county, Cal. Capt. H. H. Todd is manager.

A. P. Dron, manager of the Longfellow Gold Syndicate, Ltd., will install an electric power plant on this property near Big Oak Flat, Tuolumne county, Cal.

A rolling mill to crush gravel is to be installed on the property of the Haskill Gold Mining Co. at Auburn, Cal. D. H. Haskill, Lorin, Alameda county, Cal., is manager.

Smith & Bell of San Francisco, Cal., have decided to build a boracic acid plant on the west side of Owens Lake in Inyo county. The cost of the plant is estimated at about \$150,000.

W. R. Hall is manager of the Grizzly Mining Co.'s property at Carter's, Tuolumne county, Cal., where they intend to put in a cyanide plant, double hoist and an electric light plant.

The topworks of the Royal coal mine, near Elkline, Ia., were recently burned down. They will be rebuilt at once by the owners, Robert McClellan & Co. of Omaha, Neb.

At Kingmont, three miles east of Fairmont, W. Va., the Virginia & Pittsburg Coal & Coke Co. has commenced operations on what will be one of the best plants in the state.

The Wylie Coal, Mining & Rock Co. of Fort Smith, Ark., has been incorporated, with M. B. Wylie as president. Others interested are: L. F. Biltman, Walter Ayers, W. N. Ayers, W. R. Martin, B. A. Harrison and others. The company will mine coal and rock.

The Daugherty Mining Co. of Pierce City, Mo., has been incorporated with capital stock of \$10,000, by J. M. Daugherty and J. G. Lowdon of Abilene, Tex.; C. W. Thompson of Pierce City; C. P. Hamilton of Purdy, and others.

John Grant of Detroit, Mich., has bought the Galena, Bugle, Bull of the Woods claims, and a one-third interest in the Cora H. group of veins at Central City, Colo. The purchaser will start at once to put the property in condition for deeper development work.

It is reported that a big strike has been made in the Golden Eagle mine, Harqua Hala group, Phoenix, Ariz. If the find proves worthy of development a portion of the company's big stamp mill will be moved from its present site to a point on the Golden Eagle.

Frank Husted, Ed Hovelman and John Harbottle of Chihuahua, Mex., have purchased the silver property of Don Feliciano Rodriguez at Guanzaparez, and are organizing the "Three H." Mining Co. with a view to working the property at once.

Ambitious miners, as well as those connected with metallurgical establishments, who desire to obtain better positions and higher wages, should investigate the free scholarship offer made in another column by the American School of Correspondence, Boston, Mass. Situated in a large city which is a recognized educational and industrial center, this well-known correspondence school has many natural advantages in teaching the theory of the trades and engineering professions. Without leaving home or losing time from work, the student pursues a thorough course of study under the direction of able instructors, who are always ready and willing to assist him. Instruction papers, prepared especially for teaching by mail, are furnished free. These papers, written in clear and concise language, as free as possible from technicalities, are much superior to ordinary text-books on the subjects of which they treat. In addition, special information regarding any difficulties in their studies is furnished students without extra charge.

CORRESPONDENCE

CALIFORNIA.

[From Our Special Correspondent.]

Santa Ana, Cal., Nov. 12, 1900.

The United Mines Mining Co., recently incorporated, has purchased the following mines and claims in the New York mining district near Manvel, San Bernardino county: The Old Shoe mine, the Red Bug, Patsy Bolivar, Harmony, Standard, Polka Dot, Bull's Eye, Full Moon, Half Moon, Meteor, and Coined Money claims and one-half of the Central claim (all known as the Old Shoe group), a three-fourths interest in the Lookout and Little Giant claims, and one-half of the Jason and Fellowship claims.

This company has also secured a one-tenth interest in the following claims: Good Hope, Horse Shoe, Columbia, Olympia, Modoc, Times, Little May, Midas, Mammoth, and Joe's Wonder. These claims comprise in all about 600 acres of ground. There is good gold ore in the Old Shoe and Good Hope mines, and the others are as yet only prospects, the ores of which have shown good assay values.

This company owns the full-paid license of the United States Letters Patent No. 556,690, a process for precipitating gold from aqueous solutions.

COLORADO.

[From Our Special Correspondent.]

Denver, Colo., Nov. 22, 1900.

With the discovery of tungsten at Nederland, Boulder county, and the quantity of this new mineral that can be furnished, the most perplexing question now confronting the owners of the properties is, what shall we do with the ore after it is mined? Is there a demand for it, and an open market wherein the mineral can be shipped, and sold, like gold, silver, copper, lead and iron ores? The ore is concentrated six tons into one and then runs from sixty to eighty per cent tungsten acid.

The metal is worth from fifty cents to sixty cents per pound, or about \$1,000 per ton. Recent demonstrations by the United States government convince those in charge that a projectile covered with tungsten would penetrate the hardest kind of steel armor, therefore the metal should be in great demand in this age of advanced science.

If there is a market value and purchasing agency for this ore, the Journal would confer a favor on the miners and prospectors of Boulder county by publishing the same at an early date.

A new system of mining or rather exploiting the mineral zones of Boulder county has been inaugurated within the past year. Immense bore or tunnels have been projected, and work commenced on them. The purpose is to cut through the mountains and strike the veins at great depth, and develop the lodes as they are encountered by the cross-cut tunnel.

To carry out this system of mining successfully will require a considerable amount of capital and unlimited patience. There are at least twenty tunnel schemes now in active operation, and as many now under careful consideration.

Years of active work will have to be carried on before returns can be expected under the most favorable conditions. Yet it is a grand scheme to satisfy curiosity and develop the mines in any camp.

The Wellington Gold Mining Co. is doing great development work on the President mine of Ward, Boulder county. The ore is a sulphure of iron and copper, carrying values of \$100 per ton. The main shaft has reached a depth of about 200 feet, revealing a beautiful ore body in the bottom of the shaft that increases in size and value with every foot in depth. Great care and system has been exercised in developing this property by the manager, by making every dollar invested count to its fullest extent. A new hoisting plant has been ordered for the property, and will soon be placed in position to supersede the whim. This will facilitate matters wonderfully, and enable the manager to prosecute the development of the property with greater energy and dispatch.

The B and M mine is in close proximity to the President, and is turning out large quantities of ore for its forty-stamp mill and the smelters in Denver and Boulder. The entire camp is making greater efforts in the line of systematic mining, with marked results in the output of gold for the present year.

Wm. M. Rule.

NEW MEXICO.

[From Our Special Correspondent.]

Red River, New Mexico, Nov. 17, 1900.

The Red River Copper Co., which has a bond and lease on the Copper King group, has installed a steam hoisting and pumping plant. It has begun steady work with two shifts and will push development during the winter.

Four loads of machinery for the June Bug Mining and Milling Co.'s mill have arrived. The building is finished and the machinery will be placed as rapidly as possible. When completed the mill will have a capacity of forty tons a day and will, for the present, do custom work, besides treating the company's own ores. It is a concentrating mill and will be a great benefit to the camp.

The owners of the Banker lead are building a road to their mine. It is to be a toll road and will accommodate a number of good claims already having hundreds of tons of partially free milling ores on their dumps awaiting a means of transportation to the June Bug mill.

The Rio Hondo Mining Co. has thirty men at work developing the Frazier group of gold-copper claims on the Rio Hondo.

Eastern capitalists have secured control of twelve miles of placer ground on the Rio Grande from the mouth of the Rio Colorado to the mouth of Rio Hondo.

The mining interests of Taos county are now in better shape than ever before, and from now on systematic development and production will be the rule.

GENERAL NEWS

ARIZONA.

A patent for twenty-six mining claims near Jerome has recently been granted to the Verde Queen Copper Mining Co. These claims have become known as the Nautical group of mines, because of the nautical terms used as names of the claims.

Development work is being carried on at the Draper gold mines two miles from the Sheep Trail mill, at Pyramid, where a rich vein of gold ore has been discovered. The ledge is nearly flat, very much decomposed, and rich in coarse gold.

Ore estimated to run twenty-eight per cent copper, 1,100 ounces silver and \$20 gold a ton is being shipped by the Silver King mine, Pauls

Considerable activity is reported near Pyramid, where the Homestake twenty-stamp mill is running night and day. A group of mines near the Homestake, owned by Los Angeles citizens, is being opened up by a new company. Some rich ore is being sacked for shipment.

The tunnel on the property of the Bullion Mining Co. in the Dragoons district, Cochise county, is now in 700 feet. The formation on the Copper Bullion is the same as that on the entire belt in the Dragoons, being a contact of porphyry with lime, capped with a very heavy vein of iron and manganese. Next to it is a big dike of quartz porphyry over one hundred feet in width, with perpendicular walls from fifty to eight feet in length next to the lime. The dike is continuous for 6,000 feet on the contact. Mr. Clark, general manager of the company, brought with him from the mine samples of sulphide ore taken at a depth of 150 feet in the shaft, which, when assayed gave sixty-six per cent copper, 117 ounces silver and \$227 gold a ton, making, at present values, a total of \$270 a ton.

It is reported that a rich strike of copper has been opened on the Bryant property at Turquoise mine in the Dragoons by the Turquoise Copper Co.

CALIFORNIA.

Various statistics at hand show a scarcity in the coal supply of the State of California, notwithstanding the fact that crude oil has to a great extent supplanted coal with some of the heaviest consumers. About 60,000 tons of coal from Newcastle and Sydney will be delivered direct, and most of the shipments have gone direct to the consumers. Several reasons for the shortage are offered, but the most tangible is found in the delays in loading.

The Keswick smelters are beginning to use oil as much as possible; the Southern California Railway, with nearly 100 locomotives, is using oil exclusively, as fuel, while the Southern Pacific road is converting its engines to oil-burners as fast as their oil contracts on five-year terms are closed. In view of this a coal shortage looks almost an absurdity.

At the seventy-foot level the ore on the Perris lead in the Pinecreek district of Riverside county runs slightly below \$20 a ton. The owners of the Indian Queen mine reason that by tapping the ledge which runs into their property they will encounter ore of the same grade.

The fall rains have furnished a sufficient quantity of water in Tuolumne county to enable the quartz mills on the Mother Lode to resume. Many of these mills are equipped with electrical power on account of its cheapness, but the gradual failure of the water supply that furnished the initial power caused several of them to shut down many months ago.

According to press reports, the great Iron Mountain mine, Shasta's greatest copper producer, was on fire on November 9, and it was believed that the ore is burning.

The fire, which is thought to have been caused by chemical action, started in the Peck tunnel, where it is still confined. About 1 o'clock on November 9, the men in that drift found themselves surrounded by smoke and gases and hurriedly made their exit. The management was apprised of the situation and had the men secure as many tools as possible, then the drift was tightly closed to shut off any draft which might fan the smouldering mass of rock into greater fury. Since the recent strike in this mine, the resumption of work has been gradual and there were but 100 men employed in the Peck tunnel. These were laid off, but work is still in progress in the Fielding, Cooper and other tunnels. Fires in the

ore of mines carrying great sulphide bodies is no unusual occurrence, although this is the first such experience at Iron Mountain. The ore will come out undamaged. It is roasted before being smelted in the usual treatment. The danger lies in the destruction of timbers, a possible explosion and delay. The fire may have been occasioned by the ore itself or by the rock used for filling, which came from a limestone quarry. The Peck tunnel was for some time almost unbearably hot. The miners say that the walls of the drift were too warm to touch. It was in this tunnel that the men demanded eight-hour instead of ten-hour shifts, precipitating the great strike in which the men have just acknowledged their defeat.

The discovery of a valuable ledge of copper ore at the Copper World mine has been reported. These properties are located about fifty-five miles north of Mervin at Valley Wells, in San Bernardino county. Arrangements are now under way to begin active operations on the property. The ledge is six feet wide and of an unusually good quality. The mines are to be opened under the superintendence of Mr. Ritchie. Since 1850 the United States has produced over two-fifths of the world's entire output of quicksilver. Practically all of this comes from the State of California. Out of 29,718 flasks produced in the country in 1899, 23,454 flasks came from this State.

The Morning Star mine in the Jenny Lind district, Calaveras county, is giving great encouragement and considerable work is being done. A vein has been uncovered that gives \$15 to the ton fine gold with plenty of rich sulphurates.

Everything is in readiness to commence operations at the Juniper mine near Jamestown, Tuolumne county. The shaft was reinforced from the 600-foot level to near the surface during the shut-down. Men have been put to work stoping.

At the Wagner drift mine near Oroville, Butte county, they have seven men employed, and have put in a hoisting plant. They will take out pay gravel in less than a week.

COLORADO.

The Gold Coin near Victor is said by some to be the greatest mine of the Cripple Creek district. It is owned by a private company. The mine has two continuous veins with a distance of 800 feet vertically and which have been followed on two levels for over 500 feet. It is estimated that the returns from this mine will exceed the yield of the Independence or the Portland, which have already made its owners very rich.

The Little Pittsburg, in the Leadville district, has again become active by the opening of the Discovery shaft. It was this property that some time ago yielded over \$3,000,000 from a depth of less than sixty feet.

The company now owning the Nelson tunnel at Creede, is about to institute legal proceedings with the owners of mining property reached by the tunnel, concerning ores taken from the mines through shafts, after contracts were made for the transportation of the ore through the tunnel. It is claimed that after the contract was made, ores were diverted to an extent meaning considerable loss to the tunnel company.

A most successful summer run is reported by the Emma mine in the Durango district, on the west Dolores. The vein is now approachable by two tunnels, each of which is 1,800 feet long, and a large quantity of ore is already blocked out for milling.

David Swickheimer is running a tunnel called the Wellington in the Rico district, by which he will open up a group of fourteen claims. The tunnel was started late in August, and will be run a distance of 500 feet. Much ore has already been removed and sold at a good price.

IDAHO.

After some months of drifting, the ore body in the Elkhorn and Ketchum on Wood River, has been recovered. The ore is rich in silver and lead.

A large force of men will be employed during the winter on the River Queen mine, at Seven Devils, where the owners, Haas Bros. of Weiser, are preparing to sink a shaft. Important improvements are being made at the Iron Dyke. The company contemplates putting in a matting plant early next spring.

Considerable activity is reported in the Black Hornet district, ten miles from Boise City. The Ironsides mill is working steadily, with a full force of miners at work in the mine.

The new Kendall mill purchased by John Kinckald has been received, and it will be erected on the Jupiter or Deer Creek, five miles from Idaho City. Crushing will commence in a few days.

Development work is being rapidly pushed on the Iowa and Yellow Jacket mines at Quartzberg by the War Eagle Co. Many cross-cuts have been made and other improvements are taking place. The face of the long tunnel is now over 500 feet below the surface, and by spring a depth of over 800 feet will have been attained. The vein is from twelve to fifteen feet in width, all good ore, and the new forty-stamp mill is running.

An interesting mining case is being tried at Moscow in the United States Court before Judge Batey—the Bunker Hill & Sullivan versus the Empire State, formerly the Last Chance Mining Co. In nearly every term of court held here for eight years there has been a battle royal between these two companies. For the plaintiffs the attorneys are McBride, Folsom & Lindly; Messrs. Burbridge and Burch of the Bunker Hill & Sullivan, and Jos. McDonald of the Helena & Frisco Co. are the plaintiff's leading witnesses. Judge W. B. Heyburn is counsel for the defendants, and those retained to give expert testimony are Alton L. Dickerman, Colonel N. E. Linsley, W. Clayton Miller, Frank R. Culberson and others. The Bunker Hill & Sullivan Co. owns a small triangular fractional claim on the outcrop of the vein, and brought suit to determine the extra-lateral rights of said fraction-claim. Mining men say that there has never been a parallel case in court, and are watching the proceedings and decision with interest.

MICHIGAN.

A force of men has been put at work by the Trimountain Co. building camps and clearing brush on the site of its new mill which is to be built on the west bank of a small stream emptying into Lake Superior, two miles west of the mouth of the Salmon Trout river. In 1895 the Atlantic mill was built there, and the Baltic's new mill is now being built. The steel gravity dam, the first important one of its kind in the world, is being built across the Salmon Trout, and will be held in place by its weight alone. The Baltic mill is being built for four stamps, but will start work next season with two, each of which will have a daily capacity of between 500 and 550 tons of amygdaloid rock. The October production of mineral by the two Atlantic stamps working on the Baltic rock was 128 tons, and the same in September, equal to about ninety-six tons of ingot copper a month, worth about \$33,000. This is considered an excellent showing for a mine on which the first opening was made only three years ago, and which is less than 500 feet deep.

A shipment of about fifteen tons of mass copper was recently made by the Phoenix, and it is expected to send another lot to the smelter again next month. The stamp rock broken in opening work is all stored in the St. Clair shaft, pending the building of a mill, which may be located on the mine track, or may be built on Traverse Bay, Lake Superior.

The Arnold mine has a force of 200 men on its payroll, and is turning out an average of about fifty tons of copper monthly. The mine is being managed with great economy. The Ashland, Meadow and Humboldt, explorations west of the Arnold, have been shut down for the winter.

A cargo of fifty tons Mohawkite copper ore, shipped last June by the Mohawk mine to New Jersey smelters, was taken to Swanso, Wales, no American smelters being prepared to treat arsenical ore. Returns received show \$143 per ton, and smelters want all of this ore that can be given them.

MONTANA.

On November 18, J. N. Glass of Whitehall arrived at Helena with a gold brick valued at \$4,100, the result of twelve days' work with a ten-stamp mill at the Bowery mine near Silver Star. Ten more stamps will be installed immediately. Mr. Glass believes he has a bonanza in his new property.

The Fargo mine, two miles south of Helena, has just made its first shipment, consisting of twelve tons of high-grade gold ore. Assays have shown values as high as \$500 a ton. Although but recently discovered, this mine gives promise of being a splendid producer, the ore body being large and well-defined.

A new copper camp is likely to be developed

at Stone Creek, near Dillon. Two companies are opening up prospects, one shaft being 150 feet deep. The ore carries high copper values, but little gold.

The Lehigh, Sunflower and Blue Bell claims near Philipburg, have been bonded by Cape Bros. for \$15,000. The ore shows good values in silver and copper, and some gold.

Shipments of from 100 to 125 tons a day to the East Helena Smelter have been made by the new iron mine at Elkhorn. The iron is used in the process of treating ores.

OREGON.

F. F. Lack and associates have bought the Nelson placer mines north of Baker City. They will install a hydraulic elevator and other machinery with which to begin operations on a large scale. A large area of the placer ground has been worked to a depth of eighty feet, and with the machinery about to be installed, operations can extend sixty feet further with the use of the same flume. The placers have already produced over \$400,000.

The report that the Golconda mine, in which J. T. English was supposed to be interested, had been sold to Eastern capitalists for nearly a million dollars is emphatically denied.

San Francisco capitalists have purchased the Rialto group of claims in the Cracker Creek district for \$25,000. There is a three-foot ledge on this property, carrying free gold, between a slate hanging and porphyry foot wall. The claims adjoin the Concord and May Queen mines.

A large body of copper ore recently discovered in the Grizzly mine gave samples assaying four per cent, with gold and silver values. The values increase with depth.

Seattle investors have purchased the May Belle mine in the Cracker Creek district.

SOUTH DAKOTA.

An incline shaft is now down 200 feet on a very strong ledge of copper and gold ore on one of the Black Hills Copper Co.'s properties. There are five distinct ore lodes running parallel for a distance of ten miles, and the mineralized belt is said to be about 750 feet wide. One shipment of ore recently made showed an average of 18.6 per cent copper. The Rockford copper property is to be thoroughly developed by the Black Hills company.

W. H. Buffum of New York has been at Custer supervising the development of a copper property on Spring Creek, ten miles north of Custer. A camp is being established and a shaft will be sunk 200 feet on a well-defined ledge of copper and gold ore. It is considered that the find of copper at a depth of 350 feet in the Vigilante mine north of Custer demonstrates beyond a doubt that the Black Hills copper ledges grow in value and width with depth. In the Vigilante there is a ledge four feet wide, which gives an average value of four per cent copper and about \$4 per ton gold. The shaft will be extended 200 feet further down.

The organization of the Maloney-Blue Lead Copper Co. is reported at Deadwood. The company is to open up the Blue Lead copper mine, six miles east of Hill City. A tunnel is being extended to tap a large body of copper-bearing ore which has produced a high grade of ore at the surface.

The Imperial Mining Co. is planning for the erection of a 100-ton cyanide chlorination works at Deadwood.

A. J. Johnston of Bear Gulch has organized the North American Tin Co. which owns a large group of mining claims in the Bear Gulch district. He has recently returned from several eastern cities where he secured capital to extend the work.

WASHINGTON.

A period of unusual activity is prophesied for the Townsend group of claims in Trout Creek district, eight miles from the Great Northern Railway. It is predicted that under good management this property could ship from 100 to 200 tons of ore daily that would show from \$40 to \$100 in copper, gold and silver.

It is said that an important discovery of good coking coal has been made in the foot hills of the Cascade range, twenty-five miles east of Seattle. The discovery was made by Dr. Adair of Texas, who passed a recent vacation in mountain exploration.

The Spokane capitalists who are operating in the Miller river district, sixty-five miles east of Everett on the Great Northern Railway, have let a tunnel contract on their group of copper claims.

BRITISH COLUMBIA.

In the week ending November 24, the mines of Kootenay and Trail Creek sent to market over 15,000 tons of ore. This is the largest amount shipped since the opening of the districts. Boundary was also a great contributor, having shipped over 8,000 tons. The new smelters are responsible for this big ore movement, as they afford a ready market for all the mines can produce. Two more smelters of from 200 to 400 tons daily capacity are under construction in Boundary district, and it is said that they will be ready for operation early next year. This part of the Province has made rapid strides this season.

All the principal mines in Rossland are working, and the output is from 5,000 to 6,000 tons weekly, the ore being sent to the Trail and Northport smelters.

The Hayes mine, now estimated to be worth \$1,000,000, is one of the principal shipping properties this season on the west coast of Vancouver Island. The iron mines at Seachart have also been doing a large amount of work and are now under bond to Eastern iron men. Extensive coal deposits are also being opened up near Tidewater, and a big coal trade is expected to develop soon.

The new smelter of the British Columbia Copper Co. at Greenwood will be blown in early in December. There has been some delay in the shipment of smelter machinery, but Paul Johnson, the manager of the smelting department, says that the new plant will soon be in operation. The plant's capacity will be 900 tons daily, although at first only one furnace will be started, working 300 tons daily. Reports from the company's mine are of the most encouraging nature. It is found through recent developments that the ore values increase in depth. At the 500 foot level, the ore averages seven per cent copper and \$7 to \$8 in gold to the ton. Ore is now being taken out at the rate of 1,000 tons a week, preparatory to the beginning of smelting operations.

IRON AND STEEL

INCREASED OUTPUT OF NATIONAL STEEL CO.: The opening of the Mingo Station plant of the National Steel Co. adds greatly to the company's billet capacity. The company is now well equipped for the manufacture of steel billets and will soon be producing various kinds of raw steel. Although the new plant has been in possession of the company for six months, it has just been opened. The plant employs about 2,500 men.

A NEW JERSEY SHIP YARD: A little more than a year ago the New York Ship-Building Co. began work on its new yard at South Camden, N. J. The land rights cover 130 acres with a frontage of 3,600 feet on the Delaware river. The river at this point has forty feet depth at low tide. The yard buildings are of structural steel and brick. Two slips, each to have a 100-ton traveling crane, are included in the covered structure and are large enough to accommodate the greatest work that can be foreseen. The permanent steel-laid launching ways will also be under cover. In all the great floor and overhead space of the shop-slip and ways there will be scarcely a square foot that is not directly served by one or several electrically driven traveling cranes. All shop tools, many of which are working now, are driven by independent electric motors. While the erection of structures is going on the yards are at work on three ships whose carrying capacities are 11,000 tons, 5,500 tons and 4,200 tons respectively. The largest of these, it may be noted, will exceed in rated carrying capacity the liner St. Paul. The new yards in their general plan, steel structural work, tool equipment and tool driving form a striking example of modern industrial organization.—Railroad Gazette.

PRICES RISING IN BIRMINGHAM: A correspondent of the Manufacturers' Record, writing from Birmingham just after the election, says: "The largely increased orders last week for iron clearly foreshadowed the confidence of buyers in the election of McKinley, and their anxiety to get in before the anticipated advance. The action of sellers here this morning in advancing the price of iron fifty cents per ton confirms their action as a wise one, and every confidence is felt by sellers that at the advance they will have all the trade they can care for. Approximately the sales last week aggregated 100,000 tons. At the close of business last night the sales so far this week aggregated 50,000 or more. To-day inquiries are pouring in, and there is every indication of another week of large sales, cleaning up the sur-

plus in furnace-yards. The advance of fifty cents is but the prelude to an advance of another fifty cents, and that in a few days only. The election of McKinley was anticipated by a large majority here, and opinion was universal that with it would come an advance in iron. If buyers decide to restore stocks to usual carrying amounts with them it will be only a short time before sellers will beg for a cessation of orders they cannot supply. There is but one opinion as to the advance, that is, it has come to stay, and is not a flash in the pan.

EXPORT MOVEMENTS: Exports of iron and steel from Atlantic ports continue heavy. Reports from Philadelphia say the British steamship Dunstan has cleared with a cargo of steel plates, valued at \$134,835, for Glasgow and Greenock; other like cargoes are loaded by the British steamship Hesleyside and the Dutch steamship Leonora, and the Richard Grenville, which took steel from Philadelphia to England, is returning for another cargo. Dispatches from Baltimore report that the Carnegie Steel Co. has shipped to Freemantle, Australia, 6,500 tons of steel plates, weighing 3,500 tons, making the largest consignment of the kind that ever went through the port. The Lord Dufferin sailed from Baltimore recently with 505 tons of steel bars and sixteen tons of steel plates for Belfast, and the Indore, for Liverpool, took 249 tons of steel billets, five tons of steel wire, sixty-seven tons of iron pipe and fifty-three tons of trolley poles. From New York, also, large exports have been sent. Some of the largest consignments recently are the following: The Chicago City to Swansea, 495 tons steel bars; the State of Nebraska to Glasgow, 342 tons pig iron; Etona to Buenos Ayres, 357 tons wire and iron; Alberga to China, Japan, Singapore and Manila, 1,012 tons plates, bars, pipe, nails and wire; Cheronea to Helsingør, 428 tons steel plates; Cufic to Liverpool, 267 tons steel plates; Iberian to Liverpool, 328 tons billets and pipe steel; Bristol City to Bristol, 410 tons steel bars; Georgic to Liverpool, 392 tons steel billets; Karamania to Genoa, 243 tons old steel tires and axles; Abbey Hulme to Australia, 760 tons wire, nails, pipe, pig and bar iron; Glencalrn Holywood and W. H. Connor to Australia, 1,043 tons nails, wire, pipe, steel bars and bar iron; Gianton Australia, 136 tons steel, bar iron and car wheels. Imports of iron and steel at the port of New York during the week ending Nov. 20 were as follows: From Kobe, 1,000 tons manganese ore; from Liverpool, twenty-two tons iron ore, seventy-one tons steel, 166 tons steel wire rods and thirty tons spiegeleisen; from Sweden, forty-six tons steel wire rods; from Antwerp, twelve tons structural iron; from Porto Rico, twenty-seven tons scrap iron.

PATENTS FOR NICKEL STEEL: It is announced in Pittsburg that the Carnegie Co., after negotiations with the Nickel Steel Syndicate of London, has secured complete control of the patents for the manufacture of nickel steel in America. With the Carnegie Co. making armor plate to the exclusion of others, save the Bethlehem Steel Co., and with its extending the use of nickel steel to almost all ordinary commercial steel commodities, the change in the industry will be somewhat revolutionary. The Carnegie Co. first set the pace for nickel steel axles when it specified the use of that steel in the axles of the first big order for steel cars given to the Pressed Steel Co., and railroad managers have since found that the wearing qualities were greatly enhanced. The Pennsylvania Railroad has tried nickel steel rails on its troublesome Horseshoe curve, and it is claimed that the longer life and better service of the rails will give nickel steel precedence over the product of Bessemer or open hearth mills. The Pennsylvania also has some nickel steel axles in use in an experimental way, and it is said that their satisfactory service will cause their stipulation hereafter. It was because the Carnegie Co. specified nickel steel that it secured the recent contracts for axles for the Indian and South African railroads. The new axles will be made at the Howard Axle Works, and it is believed that a large individual industry will be created by reason of the steel company's exclusive rights. The wearing quality of the Horseshoe curve rails has been noted week after week by the Pennsylvania officials and the effect on the big mountain locomotives is also watched. The officials say that probably the next engines built for that system will have nickel steel jackets for rods and all other parts subject to severe wear and strain of any kind. It is contended that nickel steel will be used in all materials subject to longitudinal or torsional strains and pressure such as would produce change of structure in ordinary Bessemer.

COLORADO FUEL & IRON: A report is being circulated that a large interest in the Colorado Fuel & Iron property is being purchased by either the Federal Steel Co. or the Carnegies. The basis for the report is that the Colorado Fuel & Iron Co., through the difference in freight rates from Chicago to the country west of the Rocky Mountains and adjacent to Colorado, is able to compete against any of the eastern manufacturers. The Illinois Steel plants at Chicago, owned by the Federal Steel Co., are its nearest competitors. Many contracts which were formerly divided up among eastern manufacturers are now shared in by the Colorado Fuel & Iron Co. at its new plant at Pueblo. The Southern Pacific, the Union Pacific, the Atchison, Topeka & Santa Fe, the Denver & Rio Grande and the Colorado & Southern, all of which formerly purchased their rails in the East exclusively, are now giving a part of their contracts to the Colorado Fuel & Iron Co. H. H. Porter, chairman of the board of directors of the Federal Steel, when asked concerning the truth of this rumor, said: "This is the first time I have heard of it." Carnegie officials here profess to know nothing about such a deal, but it was recalled that some months ago Andrew Carnegie himself declared that the Colorado Fuel & Iron Co. was the only concern in the country which he could not undersell, as the heavy freight charges provided a sort of Chinese wall against eastern competition.

COAL AND COKE

LARGE WEST VIRGINIA DEAL: On November 22 a deal was closed in Parkersburg, W. Va., by which 30,000 acres of coal land in the counties of Braxton, Gilmer and Lewis passed into the hands of New York and Pennsylvania parties, together with the Little Kanawha railroad, which will be built up the river to Burnsville and connect with the greatest coal fields in the State. The road will be made first-class. The Braxton Coal Co. has also been formed by the same parties, with a subscribed capital of \$2,000,000. A meeting of the railroad company elected as directors B. E. Cartwright, Ridgeway, Pa.; C. E. Shaffer and J. B. Bennett, Pittsburgh, Pa.; Louis Streuber, Erie, Pa., and E. E. Smithers, New York, with former local directors, among whom is Governor-elect A. B. White.

SALE OF PENNSYLVANIA COAL FIELDS: It is reported that the Consolidated Coal Co., an adjunct of the Baltimore & Ohio Railroad, is about to purchase an immense tract of coal lands in Somerset county. The area covers between 60,000 and 70,000 acres and extends from the Allegheny Mountains on the east in Shade, Stonycreek, Allegheny and Brother Valley townships to Jenner and Jefferson townships on the west. According to the Connellsville Courier, development of this new coal region will not be postponed longer than the time required to construct a railroad from a point near Beck's cut on the Pittsburgh division of the Baltimore & Ohio into the district. At the present time a Baltimore & Ohio engineer corps is at work running lines from Hillegass, at the east end of the Allegheny mountain, to Beck's cut. Owing to the fact that the engineers are at present engaged in running lines between the points named it is a fair presumption that it is their object to utilize the abandoned South Penn tunnel in order to secure the easiest grade over the mountain. The tunnel was almost completed at the time of its abandonment. This view is further strengthened by the fact that the Reading Iron & Coal Co., an interest of the Reading Railroad Co., which was to have been the eastern connection of the South Penn, has purchased and is now developing a large tract of coal land along the route of the proposed new road.

THE METAL MARKETS.

The following prices are quoted for the leading metals as we go to press:

Commercial price of bar silver in New York, 64½c.; bar silver in London, 29 11-16d. Mexican silver dollars were quoted 50½c. Exports to Europe were announced for November 29 at 530,000 ounces. Copper, Lake, 16½@17c.; Electrolytic, 16½c. Tin, \$28.50; the plates, \$1 at mill. Lead, 4.37½c. Spelter, St. Louis, 4.20c.; New York, 4.35c. Iron—No. 1 Northern, \$15.50@16.50; No. 2 Northern, \$15@16; pig iron warrants No. 2, \$9.50@10.50.

NEW INCORPORATIONS.

CALIFORNIA.

CARDIFF COAL & OIL CO., Santa Cruz; \$250,000; R. L. Cardin.
LAKE VIEW OIL CO., Bakersfield; \$200,000; G. L. Brown.
NAPOLEON OIL CO., Bakersfield; \$500,000; E. Dinkelspiel.
MOON GOLD MINING CO., Valley Springs; \$75,000; J. B. Lucas.
KEITH OIL & LAND CO., San Francisco; \$1,000,000; L. Guggenheim.
DIRIGO OIL CO., San Francisco; \$100,000; W. G. Hitch.
FIFTEEN, THREE OIL CO., San Francisco; \$200,000; C. L. Fensler.
BLUE BELL MINING CO., San Francisco; \$200,000; S. Irving.
DU VAL OIL CO., San Francisco; \$200,000; W. S. Du Val.
PARIS OIL CO., Los Angeles; \$100,000; D. O'Donnell.
LA FORTUNA OIL CO., Bakersfield; \$500,000; J. Redlick.
GALVIN GOLD DREDGING CO., Redding; \$100,000; R. M. Saeltzer.
GRACIOSA OIL CO., Los Angeles; \$1,000,000; F. Harkness.
PELLISSIEE OIL CO., Los Angeles; \$700; G. Pelliessie.

TOWNSLEY CANON OIL CO., Pasadena; \$150,000; H. Newby.

EL ZUMO PURO CO., Visalia; \$200,000; S. Mitchell.

KRAMER CONSOLIDATED OIL CO., Los Angeles; \$150,000; G. A. Neff.

KLONDYKE JEWELL OIL CO., San Francisco; \$100,000; R. J. Kerr.

GREAT MOGUL OIL CO., Los Angeles; \$1,000,000; E. T. Harden.

TIBER OIL CO., Fresno; \$500,000; W. H. McKenzie.

COLORADO.

CLEAR CREEK MINING & REDUCTION CO., Denver; \$500,000; J. H. Berry.

CHICAGO MINING & MILLING CO., D. D. Moines, Ia.; \$60,000; H. Ellsworth.

HORSE SHOE BEND TUNNEL & MINING CO., Denver; \$100,000; S. W. Widney.

INDUSTRIAL LAND & MINING CO., Denver; \$500,000; O. Smedley.

COLD KING CONSOLIDATED MINES CO., Augusta, Me.; \$100,000.

SUNSET MINING CO., Pueblo; \$500,000; L. B. Paul.

CLEAR CREEK MINING CO., Georgetown; \$1,500,000; H. P. Waterman.

HOWE PYRITIC SMELTING CO., Boston, Mass.; \$750,000; G. E. Marvin.

DELEWARE.

TELEGRAPH HILL GOLD MINING & MILLING CO., Wilmington; \$100,000; E. B. Waples.

INDIANA.

NEW ALBANY ZINC & LEAD MINING & MILLING CO., New Albany; \$100,000; A. P. Hawes.

INDIANA SOUTHERN COAL CO., Sullivan; \$50,000; J. P. Gilmour.

AMERICAN COAL CO., Indianapolis; \$10,000; C. H. Morrison.

INDIANA OIL CO., Hartford City; \$5,000; W. H. Cooley.

IOWA.

LIBERTY CENTER MINING CO., Tama; \$10,000; G. W. Ingersoll.

CLEVELAND COAL CO., Ottumwa; \$175,000; G. W. Traer, Chicago.

GILCHRIST MINING CO., Clinton; \$25,000; C. F. Alden.

JACOB PINE MINING CO., Creston; \$50,000; D. Davenport.

MAINE.

VICTORIA MINING CO., Berwick; \$500,000; E. F. Gowell.

BONANZA KING ZINC & LEAD MINING CO., Portland; \$500,000; E. S. Knight.

MINNESOTA.

SILVER CITY MINING & SMELTING CO., Minneapolis; \$1,000,000; J. F. Calderwood.

ONONDAGA IRON CO., Duluth; \$50,000; D. A. Dickinsen.

MISSOURI.

IDA MINING CO., Joplin; \$100,000; F. N. Jones.

SILVER WEDGE MINING & MILLING CO., St. Louis; \$50,000; J. E. Clark.

KING & QUEEN MINING CO., Joplin; \$150,000; Mary F. Robinson.

ZCLA MINING CO., St. Louis; \$50,000; C. E. Carroll.

LOVETT LEAD & ZINC MINING CO., Joplin; \$190,000; C. B. Campbell.

NEBRASKA

PITTSBURG LEAD & ZINC CO., Omaha; \$30,000; A. J. Green.

STAR COAL CO., Omaha; \$30,000; P. Lenaugh.

NEW JERSEY

MILL BROOK MINING CO., East Orange; \$100,000; Cleveland V. Childs.

NEW JERSEY LEAD CO., Camden; \$65,000; J. J. Bender.

RICKSON MINING & DEVELOPING CO., Jersey City; \$25,000; A. J. Smith.

PENON BLANCO GOLD MINES CO., LTD., Jersey City; \$2,000,000; K. K. McLaren.

PENNSYLVANIA

UNITED COAL CO., Pittsburgh; \$10,000; Rosa Lynn.

JOHNSTOWN COAL CO., Johnstown; \$1,200; H. C. Burkett, Greensburg.

HICKORY RIDGE COAL CO., Pittsburgh; \$10,000; A. B. Coleman.

TEXAS.

TAYLOR & SINALOA MINING CO., Taylor; \$24,000; James A. Thompson.

SOUTHERN OIL CO., Houston; \$5,000; E. J. Eyes.

VIRGINIA.

PITTSBURG MINING & MILLING CO., Culpeper; \$100,000; J. Keeling.

EAST TENNESSEE MINING & MANUFACTURING CO., Bristol; \$2,000,000; H. G. Peters.

CRANE'S NEST COAL & COKE CO., Bristol; R. M. Page, Abingdon, Va.

WASHINGTON.

GOAT MOUNTAIN MINING & TUNNEL SITE CO., Winlock; \$1,000,000; T. O. Gray, Cowlitz.

CARRIE W. COPPER MINING CO., Tacoma; \$100,000; B. C. Read.

EQUITABLE MINING & MILLING CO., Spokane; \$150,000; E. J. Field.

BRIAR HILL COAL MINING CO., Tacoma; \$50,000; C. H. Curtiss.

DURANGO BAY MINING CO., Seattle; \$1,000,000; A. G. Dominey.

FORTUNE MINING CO., Seattle; \$1,000,000; J. L. Wiggins.

PARK CENTRAL MINING CO., Spokane; \$125,000; J. P. Harvey.

PACIFIC ANTHRACITE COAL CO., Seattle; \$6,000,000; J. M. Dennett, Valley City.

GETTYSBURG MINING, MILLING & TOWNSITE CO., Spokane; P. C. Shline.

GERTIE MINING CO., Spokane; \$100,000; J. H. Travers.

CHEWELAH COPPER KING MINING CO., Spokane; \$100,000; W. S. McCrea.

NORTHERN GOLD MINING CO., Missoula, Mont.; \$500,000; C. S. Crysley.

SILVER STAR MINING CO., Tacoma; \$10,000; C. P. Devine.

CRACKER SUMMIT GOLD MINING CO., Spokane; \$250,000; J. Clark.

SIXTEEN ONE MINING CO., Spokane; \$250,000; J. A. Finch.

SCANDIA MINING & TUNNEL CO., Spokane; \$3,000,000; O. T. Mihde.

SOUTH FORK HYDRAULIC MINING CO., Spokane; \$150,000; S. R. Divine.

MILWAUKEE PALMER MOUNTAIN GOLD & COPPER MINING CO., Wehleerville; \$1,000,000; A. Wehe.

SIXTY-FOUR GOLD MINING CO., Spokane; \$50,000; R. Denzler.

MAY FLOWER MINING CO., Spokane; \$100,000; M. Gable.

LOST TRAIL CANYON MINING CO., Tacoma; \$1,000,000; J. R. Gable.

CHICKASAW MINING & SMELTING CO., Spokane; \$50,000; H. W. Greenburg.

BUFFALO CONSOLIDATED MINING CO., Spokane; \$75,000; J. R. McDonald.

PLUTO MINING CO., Seattle; \$1,000,000; A. Chilberg.

BITTER ROOT MOUNTAIN MINING CO., Spokane; \$75,000; W. D. Vincent.

INTERNATIONAL EXPLORATION & MINING CO., Spokane; \$50,000; E. Denzel.

VICTORY MINING CO., Tacoma; \$600,000; A. W. Mihis.

GOLD BASIN MINING CO., Seattle; \$1,500,000; J. O. Carlisle.

CASHIER MINING & MILLING CO., Spokane; \$75,000; J. F. Reddy.

GLADSTONE COPPER CO., Spokane; \$100,000; L. P. Hole.

The United Mines Mining Company

Is a corporation organized under the laws of the State of Delaware, with an authorized capital stock of \$200,000, par value \$100 per share. Non-voting stock and no personal liability of shareholders. Principal office at the offices of the company at 101 S. Flower Street, Los Angeles, with offices in Denver, Colorado, and in the Executive office at Santa Ana, Orange county, California. A. V. D. Denee, Secretary and Treasurer.

For the last six months the company has been in the process of liquidating its assets at liquidation value. The stock, 20,000 shares, is being sold at par value for cash. Subscriptions for these 20,000 shares have been made and paid for at par \$100 per share, we do not consider this a sufficient amount of cash than is necessary to pay off the \$200,000 due to stockholders and when fully paid, the cash thus received will be used in the furtherance of the Company's interests and the protection of its business interests. The properties will be rapidly and thoroughly developed and energetically operated so as to produce the best results for the shareholders. The production of gold, copper, lead and silver ores and oil, as well as many other business interests herewith will be vigorously handled. This is a good healthy enterprise with excellent propositions in hand for immediate operations.

REPORT

There has been developed by this company a number of contracts to follow for the oil, gold, copper and mining estates. Location, west of Marysvale, San Bernardino county, California; the Old Shoshone, Red Bug Mining Claim; Harmony Claim, Built Eye Claim, Full Moon Claim, Meteor Claim, Painted Money Claim, and one-half of the Central Claim. All these are known as the Old Shoshone Group of mines and also have a full plan for the use of the same. The oil production is about 1,000 barrels per day, and is derived from a number of different fields, ranging from one-half to one-half of the Lookout Claim, Little Giant Claim, one-half of the Jason Claim, and the Fellowship Claim; and one-tenth of the following claims: The Good Hope Mine, Horse Shoe Claim, Columbia Claim, Olympia Claim, Modoc Claim, Texas Claim, Little May Claim, Midway Claim, and the Joe's Wonder Claim, and some others, all known as the Good Hope Group of mines. This makes about 100,000 tons of valuable ground, consolidated. The oil fields are composed of silver, lead and copper, zinc and other possible mineral outcroppings. It is a paying position, and with further development this is a large and valuable property. With the great bodies of mineral outcroppings, extensive developments are at once justified and actual mining will now be done and continued.

Your correspondence and patronage are requested. In your remittances send Post office Money Orders or Drafts on New York City banks, payable to the United Mines Min-

ing Co., and address all correspondence to GILMER OTIS PEARCE, General Manager, Santa Ana, Orange county, California.

The officers of the company are:

GILMER OTIS PEARCE, President and General Manager, Santa Ana, Cal.

O. S. DENESE, Vice-President, Los Angeles, Cal.

RAY PITTENGER, Secretary and Treasurer, Santa Ana, Cal.

BUYERS' GUIDE (CONTINUED)

Queen & Co. Philadelphia, Pa. Richards & Co., Ltd. N. Y. City. R. & J. & H. Co., Ltd. London, Eng. Smith & Thompson, Denver, Colo. Col. Tay & Co. S. L. Smith & Co. Western Chemical Co. Denver, Colo.

BABBITT METAL
Joshua Hendy Machine Wks., S. Francisco, Cal.

BANNERS AND BROKERS
Lytle & Co. Oñiona, Ban

BELT DRESSING
Geo. Dixon Cornille Co. Jersey City, N. J.

BELTING
Edw P. Allis Co. Milwaukee, Wis. Gutta Percha & Rubber Mfg. Co., S. Francisco, Cal. H. & J. Lubby & Co. S. Francisco, Cal. Joshua Hendy Machine Wks., S. Francisco, Cal. Jeffrey Mfg. Co. Chicago, Ill. Robbins' Conveying Belt Co. N. Y. City. Shultz' Belting Co. St. Louis, Mo. S. S. Machinery Co. Denver, Colo.

BLACK DIAMONDS
Bernard Bandler, N. Y. City.

BLASTING BATTERIES, ETC.
N. Y. City.

BOILERS
Edw P. Allis Co. Milwaukee, Wis. California Anti-Caloric Co. S. Francisco, Cal. Colorado Iron Works, Denver, Colo. Fairbanks, Morse & Co. Chicago, Ill. Joshua Hendy Machine Wks., S. Francisco, Cal. Jno. Leffel & Co. Springfield, O. N. Y. City. Clas C. Moore & Co. Burlington, Ia. Murray Iron Works, N. Y. City. Ringgold-Coles Engineering Co. Denver, Colo. S. S. Machinery Co. Pittsburgh, Pa. W. B. Scott & Sons

BOILER COMPOUNDS
Geo. W. Lord, Philadelphia, Pa.

BOILER COVERING
California Anti-Caloric Co., S. Francisco, Cal.

BOILER TUBE CLEANERS
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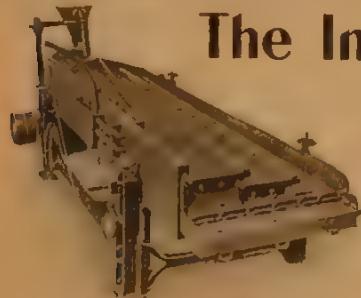
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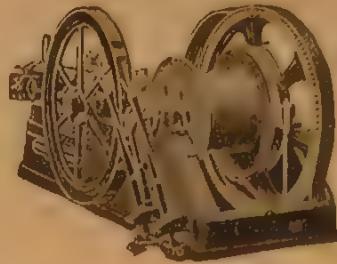
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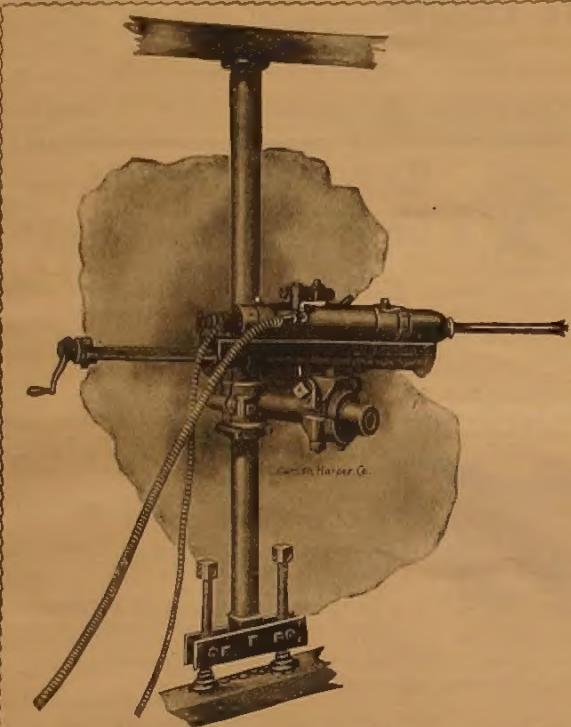
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G. L. Herkell, Albuquerque, N Mex

C. W. Kempton, Joplin, Mo

M. H. Lyon, Chicago, Ill

J. W. McCoy, N Y City

P. B. McCoy, Boise, Id

G. G. McNamara, Los Angeles, Cal

J. F. Miller, Los Angeles, Cal

R. A. Perez, El Paso, Tex

D. W. Beckhart, Phoenix, Ariz

E. S. Smith, N Y City

Simonds & Wainwright, Denver, Colo

Theo F. Van Waggoner, Denver, Colo

OIL WELL MACHINERY

Keystone Driller Co., Beaver Falls, Pa

ORE PURCHASING COMPANIES

Baker & Co., Newark, N J

Gold & Silver Extraction Co., Denver, Colo

Montana Ore Purchasing Co., N Y City

New Std Concentrator Co., Denver, Colo

R. A. Perez, Los Angeles, Cal

Buckets & Banks, El Paso, Tex

State Ore Sampling Wks., Denver, Colo

Wade & Wade, Los Angeles, Cal

PACKING

Adam Cook's Sons, N Y City

Duval Metallic Packing Co., N Y City

Goodyear Rubber Co., S Francisco, Cal

Joshua Hendy Machine Wks., S Francisco, Cal

A Leschen & Sons Rope Co., St Louis, Mo

PATENTS

C H M Agramonte, Mexico City, Mex

Townsend Bros., Los Angeles, Cal

PERFORATED METALS

Robt Atchison Perforated Metal Co., Chicago, Ill

Edw P Allis Co., Milwaukee, Wis

Cal Performing Screen Co., S Francisco, Cal

Estey Wire Works, N Y City

Joshua Hendy Machine Wks., S Francisco, Cal

San Francisco Pioneer, S Francisco, Cal

SCREENS

W H Ainsworth & Sons, Milwaukee, Wis

Colorado Iron Wks., Bridgeport, Fla

Cypress Tank Co., Joshua Hendy Machine Wks., S Francisco, Cal

Ducile Tech Co., S Francisco, Cal

Huntington Co., Wm B Scife & Sons, Pittsburgh, Pa

Wm B Scife & Sons, John Taylor & Co., S Francisco, Cal

Wade & Wade, Los Angeles, Cal